

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



17-19 May 2022

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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 ([Membership | Texas Chapter - American Fisheries Society](#)) or contact the Chapter Secretary-Treasurer:

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AMERICAN FISHERIES SOCIETY**

17-19 May 2022

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2022 TEXAS CHAPTER AWARDS AND SCHOLARSHIPS

Awards

Outstanding Fisheries Worker of the Year Award:

Education: Joshua Perkin, Texas A & M University, College Station

Student: Lindsey Elkins, Texas A & M University, College Station

Student: Garrett Stampert, Texas A & M University, College Station

Fisheries Management: Dusty McDonald, Texas Parks & Wildlife Department, Corpus Christi

Special Recognition: Annette Sudyka, Texas Parks & Wildlife Department, Heart of the Hills
Science Center

Research: Clint Robertson, Texas Parks & Wildlife Department, River Studies

Best Presentation Awards: 2021 Annual Meeting

Professional Presentation: Benjamin Walther, Texas A&M–Corpus Christi

“Tracking hypoxia exposure and consequences in the northern Gulf of Mexico with chemical proxies”

Student Presentation: Erin Nguyen, Texas A&M–College Station

“Drier and dire: Ecological forecasting and conservation contingency planning for imperiled Great Plains fishes in Texas”

Professional Poster: David Peterson, Stephen F. Austin University

“A 70-year regional perspective of an east Texas urban fishery”

Student Poster: Rebecca Mangold, Texas A&M–College Station

“Does spatial location matter when estimating stream fish richness? A test of spatially constrained rarefaction in the Colorado River Basin, Texas”

Sport Fish Restoration Outstanding Project Award, American Fisheries Society, Fisheries

Administration Section: “Repatriation of Guadalupe Bass to the Blanco River”

Scholarships –

Texas Chapter American Fisheries Society

Graduate (M.S.) – Neina Chapa – Texas A&M University—Corpus Christi

Graduate (M.S.) – Owen George – Texas Tech University

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

Undergraduate (B.S.) – Johnathan Ellard – Texas A&M University—College Station

Graduate (M.S.) – Noah Santee – Texas A&M University—College Station

Graduate (M.S.) – Nick Weber – Texas A&M University—Corpus Christi

Graduate (Ph.D.) – Hayden Roberts – Texas A&M University—College Station

Clark Hubbs Student Research Award

Melissa Wolter – Texas State University

ORAL PRESENTATION ABSTRACTS

Species Distribution Modeling and Native Fish Conservation Area Prioritization to Guide Landscape-Level Conservation

Jane Rogosch (jrogosch@ttu.edu, U.S. Geological Survey, Texas Tech University)

Tim Birdsong, Texas Parks and Wildlife Department; James Broska, U.S. Fish and Wildlife Service; David Buckmeier, Texas Parks and Wildlife Department; Daniel Bunting, U.S. Fish and Wildlife Service; Adam Cohen, Gary Garrett, and Dean Hendrickson, University of Texas at Austin; and Kevin Mayes and Nate Smith, Texas Parks and Wildlife Department

Keywords: species distribution models, Native Fish Conservation Areas,

Integrated watershed-based conservation networks have become a primary tool for multi-species aquatic conservation across large geographic areas. In Texas, collaborative efforts between Texas Parks and Wildlife Department, University of Texas, and other partners resulted in an initial Native Fish Conservation Area network of 20 prioritized watersheds for the conservation of fish species of greatest conservation need (SGCN). Although the inception of this network has been successful for project planning and implementation, development of this effort highlighted geographic areas that were under-sampled or that required baseline ecosystem assessments of habitat, water quality, and biotic communities. Since 2013, monitoring and detailed biodiversity assessment (i.e., Bioblitzes) have provided additional data through the Fishes of Texas Project and additional support for management and conservation recommendations. Given the additional information, there is a need to update distributions and predicted occurrences of fish species, especially SGCN, and refine sub-watershed prioritization. In this presentation, we will highlight our proposed approach to developing species distribution models, refining hierarchical spatial prioritization of the NFCA network, and coordinating the use of supporting datasets and research products with conservation stakeholders and collaborative partners. Research resulting from the development of these products will address relationships between environmental factors and species occurrence, how modeling approaches influence predictions for species-environment relationships in a conservation framework, and how various conservation objectives (e.g., protect or restore habitat condition, maintain dispersal corridors, etc.) affect the ranking and selection of geographic priority areas. This process will add a critical step in aligning conservation objectives to project planning, and guide efforts to identify current research needs.

Native Fish Conservation within the Texas Native Fish Conservation Areas Network

Gary Garrett (garygarrett@utexas.edu, University of Texas at Austin)

Timothy Birdsong, Texas Parks and Wildlife Department; Dean Hendrickson, University of Texas at Austin; Kevin Mayes, Stephen Curtis, Sarah Robertson, and Megan Bean, Texas Parks and Wildlife Department

Keywords: Native Fish Conservation Areas, partner collaboration

Texas Parks and Wildlife Department, in partnership with University of Texas at Austin, has prioritized and established a statewide network of 20 watersheds uniquely valued in preservation of Texas freshwater fish diversity. Termed Native Fish Conservation Areas (NFCAs), these watersheds were identified through a spatial prioritization that considered distributions of focal fishes, habitat conditions necessary to fulfill their life histories, and watershed characteristics. NFCAs represent a holistic, habitat-based approach to restoration and protection of instream, riparian, and upland habitats, with the goal of achieving environmentally and economically healthy watersheds. Our approach enables a strategic focus

on delivery of habitat conservation projects within targeted watersheds considered “strongholds” for preservation of freshwater fish diversity. The approach encourages and facilitates coordination among landowners, non-governmental organizations, Texas and federal agencies, universities, and local governments toward delivery of shared conservation objectives with an emphasis on strategies to support maintenance of watershed processes, restoration of degraded habitats, preservation of intact habitats, and local capacity-building to ensure that conservation actions are sustainable long-term. To plan and coordinate conservation delivery within NFCAs, local, state, and federal natural resources management agencies, universities, non-governmental organizations, and other local conservation partners were invited to participate in conservation planning webinars, workshops, and field days. To date, 10 conservation planning workshops and webinars have been attended by 167 conservation professionals. Participants identified and prioritized 227 specific conservation projects that could be implemented to conserve native fishes and their habitats within the NFCAs. These conservation planning workshops will continue with the goal of reviewing progress on implementation of projects and development of additional actions needed for watershed-scale conservation of native fishes and other aquatic resources in the Texas NFCAs.

Guadalupe Bass (*Micropterus treculii*) Movement is Predictable: Implications for Conservation

Jacob Wolff (jake4230@tamu.edu, Texas A&M University)

Lindsey Elkins and Joshua Perkin, Texas A&M University; Jessica Pease, Washington Department of Fish and Wildlife; Timothy Grabowski, U.S. Geological Survey; and Preston Bean and Nate Smith-Texas Parks and Wildlife Department

Keywords: restricted movement paradigm, Guadalupe Bass

Fish movement and dispersal are critical for individual survival, metapopulation regulation, and community dynamics. Movement of stream fishes was initially regarded as fundamentally restricted, with most individuals remaining within 50 m of stream during their lifetime. Later movement studies revealed two components to populations: a more abundant stationary component (stationary fish) and a less abundant mobile component (mobile fish) with little indication of individuals changing their behavioral strategy. This ‘restricted movement paradigm’ (RMP) has experienced considerable refinement since its initial inception, but its basic principles have not been tested in Guadalupe Bass (*Micropterus treculii*). We assembled Guadalupe Bass radio telemetry data from the Pedernales, South Llano, and Colorado rivers in Texas to test the RMP. We developed models for movement expected under the RMP using fish size, caudal fin aspect ratio, stream size, and time since tagging within the R Statistical Package ‘fishmove’, and then compared these expectations with observed field data. Results revealed a consistent pattern of leptokurtosis, i.e., a distribution of movement distances characterized by a high peak representing stationary fish and long tails representing mobile fish. We also found RMP-modelled predictions frequently matched field observations for the mobile component in the South Llano River (67% of observations), Pedernales River (83%), and Colorado River (100%); as well as the stationary component in the South Llano River (56%), Pedernales River (78%), and Colorado River (78%). The models were most accurate after 100 days of tracking when water temperatures warmed and fish were more active. We plan to use the information from this model to inform habitat connectivity prioritization schemes to benefit conservation and management of Guadalupe Bass.

Assessment of mussel and fish communities in a Northern Chihuahua desert stream

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Christa Edwards and Timothy Bonner, Texas State University

Keywords: Delaware River, Classifying community, Texas Hornshell

The Delaware River, located in the northern Chihuahua Desert of Texas and New Mexico, is a moderately saline tributary of the middle Pecos River and provides habitat for state-listed and federally-listed aquatic organisms. Purposes of this study were to document existing mussel and fish communities within the Delaware River -Texas Reach, a reach of the river with limited access and, therefore, limited historical collections. Study objectives were to quantify riverine habitats, mussels, and fishes within the Delaware River across multiple sites and seasons in 2016 and 2020. Live freshwater mussels were not detected among nine sites, but multiple long-dead valves of the Texas Hornshell *Popenaias popeii* were found. A total of 16,027 fishes was collected and 13 species were identified among 143 mesohabitats. Fish communities shifted from upstream to downstream, attributed in part to a longitudinal specific conductance gradient with fresher water upstream (mean $\pm$ 1 SD: 1,325 μ S/cm $\pm$ 142) and more saline water downstream (2,994 μ S/cm $\pm$ 712). The most abundant species was Mexican Tetra *Astyanax mexicanus* in the Spring season and *Cyprinella lutrensis* in the Summer season. Notable fishes included populations of the state-listed Headwater Catfish *Ictalurus lupus*, although hybridized with the Channel Catfish *Ictalurus punctatus*, and Gray Redhorse *Moxostoma congestum*. Survey information and habitat descriptions will aid in future biomonitoring of the Delaware River, and potentially repatriation efforts of the Texas Hornshell, in a region where 51,000 oil and gas wells were drilled since 2012.

Ecological Influences on the Occurrence and Density of Fountain Darters (*Etheostoma fonticola*) in Two Spring-Fed Ecosystems of Central Texas

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Brad Littrell and Edmund Oborny, BIO-WEST, Inc.

Keyword: Fountain Darter, Comal River, San Marcos River, ecological filters

The occurrence and abundance of darters (Percidae: Etheostomatinae) are driven by multiple ecological factors at varying spatiotemporal scales. The Fountain Darter (*Etheostoma fonticola*) is an endangered small-bodied darter endemic to the spring-associated Comal and San Marcos river systems of central Texas. Past studies have independently examined the effects of hydrology, habitat, and interspecific biotic interactions on Fountain Darters, but have not integrated them to assess which of these factors have the greatest influence on their populations. For this study, we applied a multiscale non-nested filtering framework to examine ecological influences on Fountain Darter populations. We used boosted regression trees to predict Fountain Darter occurrence and density based on a suite of variables from four ecological filters (short-term hydrology, spatiotemporal factors, microhabitat, biotic interactions). All models performed well and were able to generalize to out-of-sample data. We found that microhabitat was consistently the most important filter and variables related to aquatic vegetation were the strongest predictors of population performance. Darters were positively associated with increased coverage of vegetation and areas dominated by taxa with more complex physical structure. Variables within the remaining filters were generally much less influential, except for hydrology in the San Marcos River. We found that Fountain Darter occurrence and density were positively associated with lower river discharge, which may be related to the influence of high flow events on aquatic vegetation coverage (i.e., habitat availability). Our results highlight the importance of submerged aquatic vegetation in structuring Fountain Darter populations and emphasize the importance of maintaining diverse aquatic vegetation communities to ensure long-term persistence of the species.

Flow-recruitment relationships for Shoal Chub (*Macrhybopsis hyostoma*) and implications for managing environmental flows

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Matthew Acre, US Geological Survey; Johnathan K. Ellard, Texas A&M University; Tony Rodger, Oklahoma Department of Wildlife Conservation; Joe Tringale, Texas Conservation Science; and Kirk Winemiller and Lauren Yancy, Texas A&M University

Keywords: Shoal Chub, environmental flows, rate-based approaches, Brazos River, BBEST

River regulation and flow regime alteration by dams and reservoirs have impacted fish assemblages globally. The field of environmental flows emerged from the concept of managing flows in regulated rivers to sustain natural ecosystem functions and native biota. However, our understanding of the ecological consequences of flow alteration and benefits of flow restoration lag behind our ability to manipulate flows, and there is a need for broader development of flow-ecology relationships. Current practices for establishing flow-ecology relationships have shifted from state-based methods that use snapshots of ecological condition toward rate-based methods that link ecological processes, such as population dynamics, to hydrology. We adopted a rate-based approach to evaluate environmental flow standards for the lower Brazos River, Texas, analyzing the relationship between recruitment of Shoal Chub (*Macrhybopsis hyostoma*) and flow regime components. We collected 254 age-0 Shoal Chub (9–40 mm total length), extracted otoliths to estimate age in days, and used a generalized additive model (GAM) to regress the number of recruits that hatched on a calendar date against flow regime metrics such as magnitude, rate of change, and timing since flow passed thresholds recommended by the Brazos Basin and Bays Expert Science Team (BBEST). Flow magnitude, rate of change, and timing were significant predictors that collectively explained 42% of variation in recruitment. Hindcasting the GAM to 1900–2021 showed a general reduction in recruitment during the interval following commencement of flow regulation of the lower Brazos River. High recruitment was positively correlated with years in which most or all BBEST flow targets were attained, whereas low recruitment was associated with drought or flood years when few or no BBEST targets were attained. Our rate-based approach facilitates quantitative analysis of flow-ecology relationships with precision suitable for interpreting ecological mechanisms and modeling that allows both hindcasting and forecasting ecological responses to flow scenarios.

Seasonal Flow Dynamics Exacerbate Overlap Between Artisanal Fisheries and Imperiled Ganges River Dolphins

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Keywords: Ganges River dolphin

Here we quantify the effects of artisanal fisheries on the ecology of a small cetacean, the Ganges River dolphin (*Platanista gangetica gangetica*, GRD), in a large river system of Nepal. We examine the size-classes of fisheries' catches, behavioral changes in GRD in response to fishing activities, and diel overlap between GRD and fishing activity. We observed high human exploitation rates (> 60% of the total catch per effort) of GRD-preferred prey sizes, indicating risks of high resource competition and dietary overlap, especially during the low water season when resource availability is reduced. Competitive interactions in the feeding niches during the low water season, plus temporal overlap between the peak exploitation and critical life-history events (e.g., reproduction), likely have ecological consequences. Furthermore, we detected a 48% (95% CI 43–52%) increase in the chance of behavioral changes among dolphins exposed to anthropopressure (fishing activity), risking social behavior

impairment in exposed dolphins. The higher diel overlap and increased diel coefficient as the surveys progressed towards the monsoon season suggest temporal shifts in GRD socio-behavioral states and seasonal effects on resource partitioning, respectively. This work identifies drivers of small cetaceans-fisheries interactions and their consequences, and can be used to help reduce biologically significant fishing impacts on small cetaceans. As the demand for water and fishing opportunities is anticipated to exceed the current supply, mitigation strategies that balance the ecology and human needs by considering the ecology of the top predator can offer the best aquatic resource management practices that could be beneficial to Texas aquatic resource management authorities, whose aim is to maintain healthy ecosystems while supporting many industries, including recreation, tourism, commercial fishing, transportation, and water supply.

Population Structure, Habitat Use, and Ecological Aspects of an Imperiled Cyprinid the Sabine Shiner (*Notropis sabinae*) in East Texas Streams: A 20-Year Perspective

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Keywords: Sabine Shiner, species of greatest conservation need, Banita Creek, La Nana Creek, microplastics

Populations of the Sabine Shiner (*Notropis sabinae*), a small-bodied cyprinid, were historically reported as stable and abundant in East Texas streams. However, contemporary surveys have yielded few individuals in the main section of the watershed. Despite being listed as a species of greatest conservation need in Texas, little information is available about the ecology and current status of populations inhabiting East Texas streams. Herein, we examined the populations of Sabine Shiner in two streams within the La Nana Creek watershed, located in East Texas. We resampled streams that were assessed 20 years ago where the species was reported to be abundant. On a seasonal basis of one year, we investigated movements, habitat associations, population structure, reproduction, and diet of the Sabine Shiner. Our monthly surveys included in-stream habitat and water quality measurements, and fish tagging via Visual Implant Elastomer tags which allowed us to estimate population size. We hypothesized that habitat alterations over the last 20-years, due to urbanization, have affected the population size of this species in local streams. Our Banita Creek site had shallower water and lower water flow, with more diverse instream habitats, consisting of substrate with small gravel, compared to sites in La Nana Creek. Banita Creek also had lower values of salinity, conductivity, and turbidity. Over a year-long survey, we collected 267 Sabine Shiners from Banita Creek and 10 individuals from La Nana Creek. Out of this total, 169 individuals were tagged with a recapture of 95 individuals from a small reach on Banita Creek indicating a potential isolation of this population in this urbanized creek. Reproductive individuals were also observed throughout the entire year possessing highest fecundity in the fall, with all mature females having multiple egg clutches and average number of 280 oocytes. Stomach content analysis confirmed the insectivorous habits of this species, with a new item (e.g., microplastics) reported.

Considering Microplastics in Fisheries Management

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Lyric Buxton, Stephen Midway, Michael Kaller, and Mark Benfield, Louisiana State University

Keywords: microplastics

Microplastics are a growing concern in aquatic systems as they pose both physical and chemical threats to organisms that encounter and consume them. It is important to understand microplastic dynamics as they play out in lake ecosystems. Microplastic loads can differ between habitats, species, or be coming from external sources. This project is designed to quantify microplastic types and amounts in sediment, water, selected fish species, and macroinvertebrates.

From the Bottom to the Top: Microplastics Abundance and Diversity in Aquatic Food Webs of Rural-Urban Streams in East Texas

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Keywords: microplastics, Big Cypress Bayou, La Nana

Microplastics in freshwater ecosystems are becoming a critical issue worldwide. While plastics accumulation is observed in most aquatic ecosystems in Texas, little is known of the occurrence, types, and abundance of microplastics in Texas streams and their potential of bioaccumulation in stream food webs. Using samples from rural and urban streams in East Texas, we examined the abundance and diversity of microplastics in the water column, sediments, and stomach content of fishes within different trophic guilds. We hypothesized that microplastic abundance would be higher in samples from urban streams because of the increased exposure to anthropogenic and industrial activities from the surrounding cities compared to rural areas. Rural (virtually undisturbed) streams were located within the Big Cypress Bayou while the urban streams were located within La Nana watershed. Water samples were collected in glass jars while sediment samples were collected in 45ml polypropylene tubes. Fishes spanning different trophic guilds were collected using a seine and electrofishing. Samples were examined and microplastics were quantified by shape and color. Diversity of microplastics, which include microfilaments of different colors and microbeads, did not vary significantly between sites or among sample types. However, abundance of microplastics was greater in samples from urban compared to rural streams. Microfilaments were more abundant in the water column and stomach contents of fishes compared to sediment samples, which contained more microbeads. Insectivorous (e.g., sunfish and shiners) and carnivorous/piscivorous (e.g., Largemouth Bass, Warmouth Sunfish) fishes had the highest abundance of microplastics compared to other trophic guilds. Our findings provide insights into the abundance and transfer of microplastics in stream food webs in East Texas. While urban streams appear to contain higher abundance and diversity of microplastics because of anthropogenic inputs, rural streams are still being affected by this environmental issue.

Air, Land, and Water Variables and Their Association with the Temporal Onset and Spatial Distribution of Toxic Blooms of *Prymnesium parvum* in Reservoirs of the Southern Great Plains, USA

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Reynaldo Patiño, U.S. Geological Survey, Texas Cooperative Fish and Wildlife Research Unit, Texas Tech University; and Carlos Portillo-Quintero and Cade Coldren, Texas Tech University

Keywords: *Prymnesium parvum*, glyphosphate, Colorado River, CO₂

This study examined the association of air, land, and water variables with the appearance and distribution of *Prymnesium parvum* blooms in reservoirs of the Brazos River and Colorado River, Texas (USA). One impacted and one reference reservoir were selected per basin. Land cover types and agricultural pesticide use were estimated for the whole watershed (WW) and a 0.5-km zone on either side of streams (near field, NF). Variables were expressed in annual values. Objectives were to determine (1) changes in environmental conditions before and after the 2001 onset of toxic blooms in impacted reservoirs (study period, 1992-2017), and (2) traits that discriminate impacted from reference reservoirs (2001-2017). Principal component and trend analyses were used to address these objectives. Of thirty-three variables examined, four were strongly aligned with the onset of blooms. Air CO₂ and Glyphosate (herbicide) use increased, whereas Terbufos and Malathion (insecticides) use decreased at NF and WW scales. Glyphosate use preceded the onset of blooms and began to increase around the time blooms were first reported in impacted reservoirs. The relevance of the decreased use of insecticides is uncertain but existing evidence suggests that increasing concentrations of air CO₂ and water Glyphosate can enhance *P. parvum* growth. Impacted reservoirs had higher salinity, which is consistent with results of earlier studies. Moreover, their watersheds had far lower wetland cover at NF and WW scales. Although the general value of wetlands in reducing harmful algal bloom incidence by reducing nutrient loads has been previously recognized, they can also capture pesticides and therefore diminished wetland cover could magnify Glyphosate loads streaming into impacted reservoirs. In conclusion, increased air CO₂ concentration and Glyphosate use may have contributed to the establishment of *P. parvum* blooms in reservoirs characterized by relatively high salinity and minimal wetland cover over their watersheds.

Tracking Hypoxia Exposure and Consequences in the Northern Gulf of Mexico with Chemical Proxies

Benjamin Walther (benjamin.walther@tamucc.edu, Texas A&M University - Corpus Christi)

Tyler Steube and Matthew Altenritter, SUNY Brockport; and Apria Valenza, University of Florida

Keywords: Dead Zone, hypoxia, otolith chemistry, Gulf of Mexico, tissue isotope assay

What happens to fish that are exposed to hypoxia and survive? Answering this question requires lifetime records of exposure histories, which can be provided by redox-sensitive markers in fish ear stones, or otoliths. We applied this approach to quantify the effects of sublethal exposure in mobile fish from the northern Gulf of Mexico “Dead Zone”. Although sublethal exposure rates were higher than expected and consistent across years (33-37% of sampled fish), we found limited evidence for carry-over effects of exposure on lifetime size-at-age growth trajectories for fish, suggesting some life history parameters in this species are relatively resilient to hypoxia. Furthermore, the ‘traits-of-survivors’ as measured by variables such as duration, intensity and frequency of the exposure history did not differ between years, within cohorts, indicating limited differential mortality after the first year of life. Finally, we

coupled tissue stable isotope measurements with otolith chemistry to assess whether hypoxia displaces demersal foragers to pelagic food webs. Hypoxia-exposed fish had expanded isotopic niches compared to non-exposed conspecifics, indicating potential displacement from benthic food webs. However, the magnitude of isotopic displacement was individually variable and correlated with the magnitude of hypoxia exposure. The sublethal effects of hypoxia are thus complex. Coupled otolith chemistry and tissue isotope assays offers a novel way to unravel the dynamics of this growing environmental stressor.

Use of a Novel Gear Type (Fyke Net) to Document Elopomorph Recruitment in Texas

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Justin Hansen and George Guillen, Environmental Institute of Houston, University of Houston – Clear Lake

Keywords: American Eel, fyke nets, species of greatest conservation need

The American Eel (*Anguilla rostrata*) is a facultative catadromous fish. Data are lacking related to juvenile (glass eel and elver) recruitment into the bays and estuaries of the Gulf of Mexico. American Eel are considered a Species of Greatest Conservation Need by the Texas Parks and Wildlife Department. The study goal was to determine distribution, abundance, habitat associations, and recruitment timing of glass and elver American Eel in Texas. Small-mesh fyke nets, specifically designed and deployed to select for small-bodied organisms displaying a net upstream movement, were used. The first phase of field work was a year-round, broad spatial scale, effort (August 2018-July 2019); the second phase focused on a sub-set of sites within a focused temporal scale (March-July 2020). Cumulative soak time effort was 6,852 hours. A total of 130,860 fishes were collected representing 71 species from 34 families. While no American Eel were captured, other Elopomorphs, [Speckled Worm Eel (*Myrophis punctatus*), and Ladyfish (*Elops saurus*)] were collected. Habitat and water chemistry variables were examined for correlation to Elopomorph presence. Water temperature, salinity, dissolved oxygen, Secchi depth, and the total percent cover of in-stream cover were all significant variables predicting the detection of Elopomorphs during a sampling event. These findings suggest that fyke nets are effective at capturing early life stages of Elopomorphs as they ingress. There were challenges with this gear in the dynamic and highly productive tidal creeks of Texas; namely, excessive catch in very narrow tidal creeks, and predation and net damage from Blue Crab (*Callinectes sapidus*). If juvenile American Eel were present, in high abundances, during the dates and locations surveyed, we would have likely detected their ingress. Future surveys using other monitoring methods (eel ramps and plankton nets), and environmental DNA should increase the likelihood of detecting, even highly sporadic, recruitment events.

RVariation in Habitat Use and Trophic Dynamics of Catadromous Fish (*Anguilla rostrata*) in Sub-Tropical Texas

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Dean Hendrickson, University of Texas at Austin, and Benjamin Walther, Texas A&M University - Corpus Christi

Keywords: American Eel, stable isotopes, barium

Habitat use and food-web dynamics of American Eel (*Anguilla rostrata*) have been rigorously studied in temperate regions along the East Coast of North America. This research has been vital in identifying

essential habitat and delineating migration patterns for the species in that region, but similar rigor has yet to be applied to studying the species in the more southern extent of its distribution like the Gulf of Mexico, Caribbean, and Central America. This project in sub-tropical Texas attempts to remedy a knowledge gap for the species in the region by using otolith microchemistry to elucidate the frequency, duration, and intensity of transhaline migrations and muscle tissue stable isotope analysis to serve as a secondary migration proxy and provide insight into trophic interactions. Samples were obtained by a concerted effort between state officials and citizen scientists. Muscle tissue stable isotope values of $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and $\delta^{34}\text{S}$ showed significant differences between 7 sampling regions, with differing variability within each region suggesting American Eel make use of multiple habitat types in Texas. Patterns in the ratio of barium to calcium (Ba:Ca) deposition in fish otoliths are indicative of temporal shifts in salinity most commonly associated with migrations between freshwater and estuarine or marine environments, Ba particularly is a powerful tracer in Texas' hydrological systems due to the state's limestone dominant geological make-up. The inclusion of barium, in conjunction with muscle tissue stable isotope analysis, will provide a more detailed history of habitat use of American Eel in Texas.

A Comparison of Fish Community Assemblages at High- and Low-Profile Artificial Reefs in the Western Gulf of Mexico using ROV Surveys

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Richard Kline, University of Texas Rio Grande Valley

Keywords: artificial reefs, Gulf of Mexico, ROV, Rio Grande Valley Reef, GoPro

In the Gulf of Mexico natural reef cover is limited and has decreased due to human activity. Artificial reefs are constructed to supplement natural reef substrate and are made from a variety of manmade materials. These structures provide habitat for many recreationally and commercially important fish including snapper (Lutjanidae) and grouper (Serranidae) species. These species have shifting habitat requirements as they age and may require different types of structure to provide the necessary components of nursery, juvenile and adult fish habitat. Artificial reefs are expensive to build and deploy, so it is important to determine the most efficient combination of reef structures which can support healthy fish communities. This study occurred in the Rio Grande Valley reef, located 7.3 nm off the coast of South Padre Island. The section of the reef in this study consists of 51 sites composed of 9 different combinations of high-profile ($\approx 3\text{m}$ tall) concrete pyramids and low-profile ($>0.5\text{m}$ tall) cinder block platforms deployed in a randomized complete block design. The objectives of this study are: 1) to determine the optimum configuration of reef structures by analyzing the differences between fish communities associated with each of the nine combinations 2) determine if the addition of low-profile platforms support more juvenile fish than pyramid structures alone. To obtain this information we used a remotely operated vehicle (ROV), outfitted with five GoPro cameras, to visually survey the fish communities associated with each habitat array.

The Storytelling of Science: Improved Communication Techniques to Convert Science to Action

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Keywords: communication, ABT Development

This talk will review some successes and failures in scientific communication and provide a pragmatic foundation for a paradigm shift in communication methods including non-verbal cues, tone, and the ABT Development (AND, BUT, THEREFORE) method as used in Hollywood. As one of the most

influential industries in the world, the movie industry both reflects, and changes, societal norms. As scientists struggle to ensure sound scientific policies are implemented in areas like climate change, their data is often swept aside by societal opinions and needed scientific advancements and policy change are stymied. One approach to addressing this seeming impasse is to study some of the mechanisms Hollywood uses to shape societal views. One of these includes ABT Development. This technique leverages story telling techniques (ex. singular narrative, visual appeal, and emotional investment) and the brain's hardwired need to help find solutions to an identified problem. By studying and honing communication methods shown to be highly effective, scientists can begin to redevelop their messaging to ensure successful societal adoption of science and policy recommendations.

Drier and Dire: Ecological Forecasting and Conservation Contingency Planning for Imperiled Great Plains Fishes in Texas

Erin Nguyen (e.nguyen@tamu.edu, Texas A&M University)

Joshuah Perkin, Texas A&M University, and Kevin Mayes, Texas Parks and Wildlife Department

Keyword: nongame species, species of greatest conservation need, pelagic broadcast spawning

The southern Great Plains are home to a large and diverse number of freshwater fishes, but perhaps none are so threatened as those belonging to the pelagic-broadcast spawning (PBS) reproductive guild. This reproductive strategy consists of the release of semi-buoyant ova into the pelagic zone of streams that develop as they drift downstream. Given this flow-sensitive life history, PBS fishes are imperiled due to flow alteration, habitat fragmentation, groundwater withdrawal, and worsening climate change, particularly in regard to increasing drought frequency and intensity. We analyzed historical (pre-1990) fish occurrences and historical environmental variables including drought intensity, water use, temperature, land cover, etc., to generate 11 historical species-specific random forest models; likewise, the same process was repeated for the contemporary (1990-2021) time period with the addition of two fragmentation metrics for a total of 10 contemporary species-specific random forest models. Once cross-validated, we used the historical models to hindcast probabilities of occurrence and the contemporary models to forecast probabilities of occurrence for the near future, 2050. Our findings suggest that there was variation in the most important predictors of fish occurrence between the 11 species and within a single species through time. Overall, mean annual temperature and drainage area were consistently important in both historical and contemporary models. Water use in the historical models and fragmentation in the contemporary models were consistently an important predictor of fish occurrence, respectively. Our work documents the most updated range reduction in Texas for all 11 PBS species studied, suggesting that as mean annual temperatures increase, we can expect further declines unless swift and effective conservation action is taken. This study provides a potential prioritization process for determining which areas ought to be the target of conservation actions because they are expected to be population strongholds in the near future.

Assessing Fish Swimming Performance to Inform Stream Crossing Design and Barrier Prioritization

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Preston Bean, Texas Parks and Wildlife, and Edward Mager, University of North Texas

Keywords: stream crossings, culverts, swimming speeds, Guadalupe Bass, Guadalupe Roundnose Minnow, Guadalupe Darter, Plateau Shiner

Structures associated with stream crossings such as bridges and culverts can lead to zones of high-velocity water flow that impede the passage of fishes. Such impedance is likely to harm native fish populations by negatively impacting migrations critical to their life history strategies and by causing habitat fragmentation and local extirpation, thereby limiting population growth and distribution. To address this concern in the design of future stream crossings, swimming performance tests were conducted for four species of greatest conservation need (SGCN) native to the Edwards Plateau Ecoregion of Texas: Guadalupe Bass (*Micropterus treculii*), Guadalupe Roundnose Minnow (*Dionda nigrotaeniata*), Guadalupe Darter (*Percina apristis*) and Plateau Shiner (*Cyprinella lepida*). Maximum sustained swimming speed (U_{crit}) and maximum burst swimming speed (U_{max}) of these species were measured at three environmentally relevant temperatures (15, 22.5 and 30 °C) and will be used in calculations of maximum water velocities (U_{water}). Additionally, physiological endpoints of relevance to overall swimming performance, including metabolic rate measurements (i.e., standard (SMR), maximum (MMR) and aerobic scope (AS)) and calculations of cost of transport (CoT) and optimal swimming speed (U_{opt}) were measured. This data will help to inform recommendations of maximum water flow velocities in the design of future stream crossings and barrier modifications used in stream crossings. This presentation will discuss the protocols and methods used to collect the associated data as well as the results from the research efforts conducted.

Delineating the Fundamental Versus Realized Niche of Prairie Chub

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Keywords: Prairie Chub, Shoal Chub, BAM parameters, Red River, niche

The fundamental niche of a species is defined as the abiotic conditions under which a species could persist and differs from the narrower realized niche of a species that considers interactions with other species (biological) as well as dispersal of organisms (movement). Delineation of the realized niche of a species is possible through simultaneous consideration of biological, abiotic, and movement (BAM) parameters, and this information can be useful for conservation planning. The purpose of this study was to employ a BAM framework to estimate the realized niche of Prairie Chub (*Macrhybopsis australis*), an imperiled fish endemic to the Red River basin of Texas and Oklahoma. Our first objective was to create an ecological niche model that describes Prairie Chub occurrence based on remotely sensed abiotic riverscape variables alone. Our second objective was to incorporate biological interactions in the form of hybridization and introgression with Shoal Chub (*Macrhybopsis hyostoma*) in the mainstem Red River. Our third and final objective was to incorporate recently developed movement estimates for Prairie Chub to identify locations of accessible habitat. The full model represents a BAM-based delineation of Prairie Chub realized niche and can be used to identify locations of population sources (i.e., likely locations of positive rates of population growth) versus sink (i.e., likely locations of negative rates of population growth). Relative to the fundamental niche, the range of Prairie Chub is narrowed

because of hybridization in the eastern, downstream portion of the mainstem Red River; however, range expansion caused by dispersal into increasingly small and drying streams occurs in the western, upstream portion of the Red River watershed. Our model is useful for conservation planning because it identifies locations of source (meta)populations where resources might be allocated to preservation (e.g., maintenance of longitudinal connectivity, preservation of flow regime) based on known causes of decline for the species.

Going the Distance: Multiscale Assessment of Conchos Pupfish (*Cyprinodon eximius*) Abundance and Distribution in West Texas

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Matthew Acre, U.S. Geological Survey; Megan Bean and Sarah Robertson, Texas Parks and Wildlife Department; Ryan Smith, Texas Nature Conservancy; and Joshua Perkin, Texas A&M University

Keyword: Conchos Pupfish, species distribution model, Rio Conchos, Devils River, Dolan Creek

The goal of this study was to assess the distribution and abundance of Conchos Pupfish at multiple spatial scales. The broad-scale distribution assessment included developing a species distribution model (SDM) across the range of the species in Mexico and the United States, while the fine-scale abundance model focused on population size at the three locations where the species persists in the United States. Results of the SDM illustrated high suitability at locations in the upper Rio Conchos in Mexico and the lower Devil's River of Texas in the United States. Focal abundance estimates based on distance sampling at three locations on the Devil's River showed highest abundances in Dolan Creek near the USGS gage 08449100 (N = 2,251; 95% confidence intervals = 945-3,558), followed by the Devil's River at Pafford Crossing (N = 1,386; 826-1,947), and the Devil's River near Dolan Falls (N = 671; 301-1,042). We found Conchos Pupfish were most abundant in shallow areas with high flocculent and algal coverage, but slow water velocity. This research advances the field of conservation biology by demonstrating the application of distance sampling in an aquatic setting to develop ecological baselines and a status assessment for a rare and poorly studied species.

Fishing for Preferences: Angler-Informed Management of Coastal Species

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Rex Caffey and Stephen Midway, Louisiana State University

Keywords: Spotted Seatrout, Human Dimensions/Outreach, Louisiana, web-based survey, public scoping

Spotted Seatrout (*Cynoscion nebulosus*) are a coastal fish species that support the most significant recreational fishery in coastal Louisiana based on directed angler effort. Fishery-dependent and -independent indices have indicated that this fishery is both overfished and undergoing overfishing, particularly within the last few years. In this context, we surveyed anglers to better understand their behaviors and attitudes regarding proposed regulatory scenarios informed by stock assessment. Each scenario equivalently reduced harvest in this fishery through unique combinations of creel and size limits. Three modes of contact were used to gather preference data in a random sample of Louisiana license holders, an open access web-based survey, and information collected directly during eight public scoping meetings held throughout Louisiana. Angler support for regulation scenarios varied by each combination, with a clear preference for one regulation scenario in particular. The information collected by this study provides a case study for other fishery managers to follow while seeking to develop

sustainable management strategies which are both biologically warranted and inclusive of stakeholder engagement.

Multiscale Movement and Habitat Associations for Alligator Gar (*Atractosteus spatula*)

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Hayden Roberts and Joshua Perkin, Texas A&M University; and Dan Daugherty, Texas Parks and Wildlife Department

Keywords: Alligator Gar, movement ecology, Brazos River, Navasota River

In recent decades our understanding of Alligator Gar ecology has increased because of interest in conservation and management of the species. An emerging theme of research is the movement and habitat use of Alligator Gar. For example, stream fish movements at the population level may be represented as a leptokurtic distribution of movements consisting of mobile and stationary individuals, and this concept was recently tested and confirmed using existing Alligator Gar movement data. However, there is a need for studies of the species at finer temporal (e.g. diel cycle) and spatial (e.g. within reach) scales. The goal of this study is to assess fine scale movement behavior of Alligator Gar in the lower Brazos River and accompanying tributaries using active telemetry. To achieve this goal, we tracked a subset of five Alligator Gar from a study assessing broader scale movement patterns within the lower Brazos River. Fine-scale movements of these individuals were tracked at two-hour intervals over a 24-hour period at a location on the mainstem Brazos River and within a major tributary of the basin, the Navasota River. We found that distributions of movement distances at the individual level were normally distributed (i.e., kurtosis ~ 3), but when data were combined across individuals a leptokurtic distribution (i.e., kurtosis > 3) pattern emerged. These findings suggest that fish populations can be represented by heterogeneous movements among individuals with movements ranging from (1.8m - 2657m), even for periodic life history strategists at relatively fine spatial and temporal extents. Given this knowledge, fine-scale movement analysis of individuals that make up population level leptokurtosis may provide new information to contribute to the management practices of Alligator Gar and other species and life history strategists that are not strongly represented in existing meta-analyses of fish movement.

The Trinity River Alligator Gar Guide Tagging Program: A Win-Win for Management

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Keywords: Alligator Gar, tagging, fishing guides, Trinity River

Growing interest in charismatic megafauna, along with recognition of the importance of apex predators in aquatic systems, has elevated the status of the Alligator Gar, *Atractosteus spatula*, among both anglers and biologists. Although populations across much of their range are depressed due to historic mismanagement and habitat degradation, Texas is still home to healthy Alligator Gar stocks that support an increasingly popular recreational fishery and thriving guiding industry. Growth of the fishery prompted the Texas Parks and Wildlife Department (TPWD) to actively manage populations, including efforts to regulate harvest and understand population abundance, dynamics, and movement. Research has shown that Alligator Gar are long-lived, periodic strategists that exhibit sexual dimorphism in both size and longevity. Such life-history characteristics result in sensitivities to overharvest, requiring managers to closely monitor populations. However, fishery-independent sampling is often plagued by low catch rates, resulting in insufficient data to detect trends. Therefore, the TPWD partnered with avid

Alligator Gar catch-and-release fishing guides and anglers on the Trinity River – Texas’ premier Alligator Gar fishery – to initiate a catch-tag-release program in 2019. To date, over 2,100 Alligator Gar, ranging in length from 559 to 2,388 mm, have been fitted with individually numbered T-bar anchor tags, providing information on abundance, distribution, movement, and return to the fishery of caught-and-released fish. Based on the average catch rate during fishery-independent, riverine sampling for Alligator Gar by the TPWD, tagging an equivalent number of fish would have required about 8,000 man-hours. Thus, our partnership with anglers and guides provides an efficient way to monitor the fishery and accumulate valuable biological data, maintain and enhance relationships with constituents, and provide anglers with information of interest.

Black Bass Fisheries in Texas: An Analysis of Historic Fishery-Dependent Data

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Randy Meyers, Mitch Nisbet, and Jake Norman, Texas Parks and Wildlife Department

Keywords: Black bass fishery

Black bass fisheries (primarily dominated by Largemouth Bass, *Micropterus salmoides*) comprise the most sought-after species among freshwater anglers in Texas. The Texas Parks and Wildlife Department has routinely used creel surveys to monitor black bass fisheries in reservoirs throughout the state. We used generalized additive models to analyze creel data collected at 105 Texas reservoirs from 2003 to 2020 to evaluate seasonal, geographic, and environmental impacts on angler catch rates and effort within black bass fisheries. Predictably, black bass catch rates during the fall and spring were significantly higher than catch rates during the winter and summer, while black bass effort was also significantly higher during the spring. Geographically, black bass catch rates and effort both decreased as longitude decreased. Water level fluctuations were identified as environmental drivers of catch rates within reservoirs, with diverging impacts based on particular seasons. This study provides a baseline for comparison within future evaluations of black bass fisheries in Texas, a depiction of the key factors influencing black bass catch rates and effort, and a novel modeling approach that may be applied within a variety of fisheries research applications.

Time Series Modeling to Detect Population Trends in Spotted Seatrout (*Cynoscion nebulosus*) Along the Texas Coast

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Keywords: Spotted Seatrout, recruitment

Over the past decade, there have been several changes to harvest and size limits of Spotted Seatrout (*Cynoscion nebulosus*) in Texas, the most recent actions occurring after large mortalities following a winter storm in February of 2021. Detecting long-term population trends and sensitivity to environmental variables can lead to more informed management, especially when facing stochastic events like winter freezes. Using long-term resource monitoring data from Texas Parks and Wildlife Department’s Coastal Fisheries Division and generalized additive modeling (GAMs), this study examines trends in Spotted Seatrout recruitment and abundance across spatial and temporal scales with environmental and harvest pressure factors.

Winter Storm Uri Impacts to Spotted Seatrout in Texas

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Keyword: winter storm, Uri, Spotted Seatrout, Laguna Madre

The largest freeze related fish kill since the 1980's began as multiple frontal passages moved through Texas beginning February 13, 2021, dropping water temperatures in coastal bay systems to below the thermal tolerances of many fish including Spotted Seatrout. The storm, later named Winter Storm Uri, had significant impacts on marine fish in Texas. An estimated minimum of 3.8 million fish were impacted coastwide consisting of 61 species. Recreationally important game species accounted for 9% of the total fish kill. Spotted Seatrout were particularly impacted and comprised 48% of the kill from game species. Both the Upper and Lower Laguna Madre bay systems were hit particularly hard by this event in terms of game fish mortality. The Lower Laguna Madre had the highest mortality of Spotted Seatrout with an estimated 104,000 fish killed. The magnitude of the kill led the Texas Parks and Wildlife Commission to take emergency action in reducing harvest through size and bag limit restrictions for 180 days. Spring gill net catch rates reflected the impact of the kill within impacted bay systems showing reduced catch rates up to 44% below the ten-year mean. Upper bay systems in San Antonio Bay and Matagorda Bay which did not have the extensive fish kill based on assessments at the time of the storm showed similar reduction in catch rates. Additional regulatory action is currently being recommended by Texas Parks and Wildlife Department Coastal Fisheries staff. Current information related to forthcoming regulatory action will be shared during the conference.

Regional Assessment of Inland Fish Mortalities Associated with Winter and Cold-Shock Stresses

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Timothy Bonner, Texas State University, and Travis Tidwell, Texas Parks and Wildlife Department

Keywords: Winter Stress Syndrome, fish mortality, cold-shock stress, Tilapia

Winter is regarded as a stressful period for ectothermic animals (i.e., Winter Stress Syndrome), which can be exacerbated by cold shock stress associated with major arctic freezes. Although loosely defined, major arctic freezes consist of abnormally colder air, and therefore abnormally colder water temperatures, for several days (e.g., 2021's Winter Storm Uri). During major arctic freezes in the 1980s and in 2021, 35 million Texas marine and estuarine fishes were killed. Interestingly, few studies report the effects of winter or cold shock stress on fishes in inland waters. Purpose of this study was to describe patterns in cold weather fish mortalities attributed to winter and cold-shock stress within inland waters of Texas between 1969 and 2021 using records contained within Texas Parks and Wildlife Department's Pollution Response Inventory and Species Mortality (PRISM) database. Among 53 years, greatest percentages of the reports occurred during four major arctic freezes in 1981, 1983, and 2021. Sixteen taxa and 1,000,000 individuals were reported killed during the 53 years. Numbers of inland fish mortalities were greater in years with major arctic freezes than in years without major arctic freezes, attributed primarily to mortalities of non-native fishes (e.g., Blue Tilapia *Oreochromis aureus*). Numbers of native fish mortalities, primarily clupeids and catostomids, were not different between years with and without major arctic freezes. The 43,000 inland fish mortalities reported during the three major arctic freezes are in stark contrast to the 35 million marine and estuarine fish mortalities. Proposed mechanisms to explain cold shock mortalities in coastal environments (e.g., species within the northern extent of their range, lack of access to deeper water) are similar to inland environments, yet inland environments do not have the same level of mortalities. Consequently, the disparity between mortalities in coastal and inland environments are not readily discernable at this time.

Efforts to Fill the Mid-Coast Gap in the Cold Stunned Turtle Response

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Keywords: Cold-stunned turtles, green sea turtles, mid-coast, Uri

During Winter Storm Uri between February 13-17, 2021, over 13,000 sea turtles were cold stunned on the Texas Coast. Many of these turtles were rescued through the efforts of Federal and State agencies with the assistance of local volunteers. Unfortunately, the Texas mid-coast area, including San Antonio Bay, Espiritu Santo Bay, and West Matagorda Bay, lacked a network to rescue, care, and transport of turtles prior to and during the event, though many local people expressed a desire to help. After the freeze, Texas Parks and Wildlife Department Coastal Fisheries staff and a local Texas Master Naturalist, documented approximately 500 dead green sea turtles in Espiritu Santo Bay, San Antonio Bay, and West Matagorda Bay. Seeing the devastating effects the freeze had on the turtle population and the gap in the response network, something had to be done. Texas Parks and Wildlife staff and local Texas Master Naturalist, Brigid Berger, have worked to develop a Mid-Coast Cold Stunned Turtle Network. This network began as an idea and over time has become a reality. Working with the guidance of the Padre Island National Seashore, Sea Turtle Stranding and Salvage Network and the UT Marine Science Institute Amos Rehabilitation Keep, we have been building a network of volunteers to serve the area. This talk will summarize our progress to date.

A Study Design for Evaluating the Productivity of The Rio Grande Valley Artificial Reef Using Time Lapse Camera Data

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Richard Kline, University of Texas Rio Grande Valley

Keywords: Rio Grande Valley Artificial Reef, artificial reefs, Red Snapper, time lapse photography,

The Rio Grande Valley Artificial Reef is located 7.4 nautical miles off the coast of South Padre Island (N26 16.703, W97. 02.988) and is the largest artificial reef on the Texas coast at 2.5 square miles. The construction of the reef began to increase fishing opportunities and to provide additional habitat for snapper (*Lutjanus*) and grouper (*Serranidae*) populations. Red Snapper (*Lutjanus campechanus*) are of particular interest as they are the most abundant and highest targeted species on the nearshore reefs for recreational and commercial fishing. This study focuses on three different reef patch configurations within the reef: prefabricated concrete pyramids, low profile modules of cinder block platforms, and mixed sites containing recycled concrete railroad ties, cinder blocks, and broken concrete. The sites were evaluated using time lapse videos collected by deploying a GoPro camera, fitted with a time lapse controller, at each site. Two camera deployments occurred at each site at two-week time intervals for a 28-day view of the fish community present. The objectives of this study were to 1) determine the most comprehensive method for camera surveys and 2) determine the best time lapse procedure to gain the most accurate view of species presence. The video analyses obtained will then be used to 1) determine the difference between the three reef structure types in terms of fish abundance and assemblage and 2) determine which structural type is most suitable as nursery habitat for post-settlement Red Snapper.

Characterization of Triploid Grass Carp Stockings in Private Waters of Texas

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Keywords: Grass Carp, stocking

Ctenopharyngodon idella was legalized in 1992 for nuisance aquatic vegetation management among private waters of Texas. To date, there has been no formal assessment on the numbers of triploid Grass Carp stocked in private waters of Texas or characterization of water bodies receiving triploid Grass Carp. A challenge for a formal assessment is that triploid Grass Carp stockings are processed through multiple licensed vendors statewide and, therefore, summarizing 29 years of stocking records from mostly handwritten notes would be time consuming and likely incomplete. In this study, we characterized triploid Grass Carp stockings using Texas Parks and Wildlife Department permit applications, which document the number of applications accepted or denied, numbers of triploid Grass Carp permitted for stocking, and estimations of receiving water surface area, vegetation coverage, and vegetation type. Between 1992 and 2020, 30,387 permit applications were submitted, requesting 818,667 triploid Grass Carp. About 4% of the applications were denied. Mean number (± 1 SD) of permit applications per year was 1,048 (± 166), and mean number of triploid Grass Carp requested per year was 28,229 ($\pm 7,881$). Numbers of permit applications and triploid Grass Carp requested were similar among years (i.e., no increasing or decreasing trends through time) and were greater in East Texas than Central or West Texas. Majority of the receiving water bodies were <2.0 ha with $>50\%$ submergent vegetative coverage. Estimated cost of stocking ranged between \$200 and \$400 per ha. This assessment has benefits to landowners, as they consider the use of triploid Grass Carp as part of nuisance aquatic vegetation management plans, and to aquatic scientists, as they evaluate the efficacy of triploid Grass Carp use and the potential escapement of triploid Grass Carp from private waters to public waters.

Six Years in the Reeds: The Healthy Creeks Initiative to Control *Arundo*, 2016-2021

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Keywords: giant reed, *Arundo donax*, Healthy Creeks Initiative, Native Fish Conservation Areas

Arundo donax (giant reed) is a 20'+ tall Asian grass that has invaded riparian habitats across northern Mexico and much of the southern United States. *Arundo* forms dense, 20- to 30-foot-tall monocultures that can crowd out native vegetation, reduce and alter patterns of stream flow, increase streambank erosion, degrade fish and wildlife habitat quality, and increase wildfire risk. Since 2016, the Healthy Creeks Initiative has provided management of invasive *Arundo* at no cost to hundreds of participating landowners within several Native Fish Conservation Areas of the Texas Hill Country in order to maintain quality habitat for Guadalupe Bass and other native fishes. This presentation will discuss the project's progress to date.

Assessing the Texas Live Bait Industry as a Pathway of Introduction for Two Invasive Cyprinodontids

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Joshuah Perkin, Texas A&M University; Kevin Mayes and Monica McGarrity, Texas Parks and Wildlife Department; and Carmen Montaña, Stephen F. Austin State University

Keywords: Sheepshead Minnow, Gulf Killifish, Brazos River, Red River, baitfish

The use of invasive fishes as live bait has been shown to be a major vector of introduction in aquatic ecosystems. Bait-bucket releases have facilitated the movement of many invasive fishes throughout the United States. Two such species believed to have been introduced into inland Texas streams via bait-bucket releases are the Sheepshead Minnow and Gulf Killifish. We conducted telephone and in-person surveys of 170 live bait shops in Texas on a seasonal basis over the course of one year to investigate the potential role of the live bait industry in facilitating the introduction of these two cyprinodontids. Based on our surveys using telephone interviews and personal visits to live bait shops within the study area, we were unable to find evidence for the live bait industry being a main vector for introduction of Sheepshead Minnow and Gulf Killifish into water bodies of the Middle and Upper reaches of Brazos River and tributaries of the Upper Red River basins. Commonly live baits being sold across all seasons and bait shops were the native Golden Shiner and Fathead Minnow. While we cannot inform how these two invasive species were introduced into these aquatic systems, we confirmed their occurrence in sites of the Middle Brazos River which raises awareness for continuing monitoring these populations to evaluate potential upstream distribution expansion and ecological impacts in native cyprinodontid populations.

POSTER PRESENTATION ABSTRACTS

1

The Effect of Hard Freezes on the CPUE of Three Recreational Game Fish in the Matagorda Bay System

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Leslie Hartman and Jillian Swinford, Texas Parks & Wildlife Department

Keywords: Matagorda Bay, freeze, fish kills, Red Drum, Spotted Seatrout, Southern Flounder, Uri

Hard freezes are weather events in which air temperatures decline to -2 degrees Celsius or below for several hours. The February 2021 freeze caused a fish kill estimated at 3.8 million fishes along the Texas coast. According to Texas Parks and Wildlife's (TPWD) records, there have been three other recent historic major freezes: December 1983, February 1989, and December 1989. TPWD field estimates indicate that the 1983 freeze had the highest single fish kill event with an estimated 14.4 million mortalities. Cumulatively, 1989 resulted in higher mortalities through two separate fish kill events, 11.3 million in February and 6.2 million in December. Data from TPWD gill net surveys pre- and post-freeze from each event show a notable decrease in the catch per unit effort (CPUE) of a variety of species. In a comparison to coastwide mortality data from the 2021 freeze, Matagorda Bay recreational fish made up only 2% of the overall, coastal mortalities. This research focuses on the CPUE trends of popular game fish including Red Drum (*S. ocellatus*), Spotted Seatrout (*C. nebulosus*), and Southern Flounder (*P. lethostigma*) in the Matagorda Bay system. Southern flounder gill net CPUE appeared least impacted by the decline in temperature after each of the four freezes. Red Drum have higher overall declines in CPUE compared to both Spotted Seatrout and Southern Flounder. Since the Red Drum population is presumably large, a higher number of individuals lost may simply reflect that a smaller proportion of the population was lost, so recovery is faster. Spotted Seatrout also had a noticeable decline in CPUE and were slower to recover after the freeze events. Although there were noticeable declines in game fish CPUE, there is evidence of higher resilience for local population recovery after freeze events in the Matagorda Bay system.

2

Effective Methods of Cold-Stunned Sea Turtle Response, Retrieval, and Processing

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Claire Iseton, Caren Collins, and Leslie Hartman, Texas Parks and Wildlife Department

Keywords: cold stun, sea turtle, Uri

In February 2021, a mass stunning event of sea turtles occurred on the Texas coast where approximately 13,000 sea turtles were retrieved from Texas bays by a conglomerate of agencies. Cold stunning in sea turtles occurs when weather patterns shift suddenly, and water temperatures drop below 50°F (10°C). Due to their cold-blooded nature, sea turtles become hypothermic and stun in mass numbers in shallow bays and lagoons where access to deeper, warmer waters is difficult. Hypothermic turtles lose their ability to swim and often show no signs of life making them susceptible to predators or vessel strikes. In cold stunning conditions field teams patrol accessible shoreline to retrieve sea turtles which are transferred to facilities to gradually warm up. The Coastal Fisheries Division of Texas Parks and Wildlife played a large role in the retrieval and processing of these turtles. The methodology and set up

of the Dickinson Marine Lab intake facility allowed for efficient data collection and care of these animals. Due to climate change these events will likely become more common with increasingly irregular weather patterns and sea turtles staying in vulnerable areas for longer during warmer periods. With continued weather events like the freeze events in 2021 it is important for agencies to collaborate and share methods to improve efficiency of rescue and relief efforts. Preparedness and collaboration are key to navigating mass events such as these and as an agency we should share successful protocols to aid others in these relief efforts and solicit a cadre of volunteers to participate in retrieval. Sea turtles are often an early indicator to impacts on fisheries during cold weather events. Fish kill events usually occur on the cusp of sea turtle stunning. Having streamlined protocols and strong response effort can help better facilitate assessments of these events that often have an impact on fisheries management decisions.

3

Geological Influences on Stream Fish Communities Within the Upper Nueces River Basin

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Timothy Bonner, Texas State University

Keywords: Nueces River basin, geology

Surface and subsurface geological formations influence the spatial heterogeneity in fish communities observed in riverine networks. In this study, we quantified patterns in fish community heterogeneity within the upper Nueces River basin and correlated the patterns with surface geology. Preliminary results indicated strong concordance between fish communities and surface geology. Greater numbers of spring associated fishes were associated with streams within Cretaceous geology than streams within Pleistocene fluvial terrace deposits. The next step is to explore the mechanisms associated with the concordance (e.g., water permanency), which likely also explains why fish communities within Cretaceous geology are not identical (e.g., water permanency associated with losing and gaining reaches of streams). Understanding of natural factors influencing fish community structure facilitates the identification of anthropogenic factors affecting fish community structure.

4

Effects of Flow Variability on Fish Communities Within Impounded Waters

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Keywords: impounded waters, San Marcos River, dams, flow variability

Impounded waters created by low-head dams alter pre-existing fish communities. However, the extent of alteration can vary, ranging from minor to major shifts in fish community structure. In this study, we assessed the role of flow variability, a reported major determinant of fish communities, on a fish community within impounded water located at the headwaters of San Marcos River (Hays County). Our study design consisted of three treatments: impounded water with low flow variability, impounded water with high flow variability, and riverine habitat with high flow variability. As reported in other impounded waters, we predicted that greater number of non-native fishes, more Centrarchids, and higher trophic positioning will be found in the impounded water with low flow variability than in lentic and lotic environments with high flow variability. Demonstrating the role of flow variability on fish

communities within impounded waters will aid the process of updating aging dam infrastructure, a necessary task given that the average age of dams within the USA is 60 years old and several recent dams have failed.

5

The Influence of Depth and Season on the Nearshore Community of the Texas Gulf of Mexico

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Ethan Getz, Texas Parks and Wildlife Department

Keywords: Gulf of Mexico, fisheries-independent monitoring, long-term data

The northern Gulf of Mexico largely consists of unconsolidated or “mud-bottom” habitat which is utilized by a number of ecologically valuable and targeted species. Here, we utilized a long-term fisheries-independent dataset collected by the Texas Parks and Wildlife Department to characterize community composition within the nearshore waters (< 9 miles) of Texas. Multivariate analyses were used to assess communities collected in Gulf trawl samples from five regions between 2010-2019. Results revealed clear gradients in environmental variables including turbidity, salinity and depth along the coast. Community composition also varied seasonally and by region. Depth and season each had an impact on species abundance and SIMPROF results yielded coherence plots containing groups of species which reacted similarly to each variable. Diversity measures including evenness, richness and Shannon-Weiner diversity index (H') were also calculated for each sample and compared across depth and season. Results determined that H' increased with depth and was highest in the winter and spring. Pulses of richness were also evident in the summer and fall likely due to migration or recruitment events. These results underline the importance of collecting long-term fisheries data and detail how community analyses can provide clear trends which include economically valuable species.

6

Effects of a Catastrophic Flood Event on Macroinvertebrate Communities and Guadalupe Bass Recruitment from Two Central Texas Rivers

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Keywords: macroinvertebrates, flood, Guadalupe Bass, Colorado River, Guadalupe River, Blanco River, recovery

Based on the magnitude, duration, and timing of an extreme hydrological event, species diversity and instream habitat can be severely impacted. The Colorado and the Guadalupe River Basins in Texas experienced disastrous floods due to excessive rains in May and October of 2015. Macroinvertebrate communities were sampled from six sites on each river for six months after the October 2015 flood event in an effort to capture the impact on its community structure and their recovery periods. Guadalupe Bass were collected from the Colorado River in fall of 2016 to determine the recruitment success during the flood and years prior to it. The main objectives of this study were: a) assess the effects of a catastrophic flood on the macroinvertebrate communities, b) evaluate the relationship of environmental factors and the macroinvertebrate communities, and c) evaluate the Guadalupe Bass recruitment after the catastrophic flood. A total of 36,322 macroinvertebrates and 112 Guadalupe Bass were collected during the sampling period. This study revealed differences in the recovery period of

various macroinvertebrate community metrics from the two rivers, and the dip in Guadalupe Bass recruitment during the flood year. Key findings of this study were: a) the average recovery period of macroinvertebrate communities was about 80 days after the discharge levels had subsided, b) recovery period of macroinvertebrate communities was much longer at downstream sites in both River Basins, c) macroinvertebrate taxa showed stronger association to environmental variables in the Blanco River compared to the Colorado River, and d) Guadalupe Bass recruitment in the Colorado River was greatly affected by the flood event as seen in the weak year-class strength in the following year. Results from this study shed light on the resistance and reliance of benthic macroinvertebrate communities and potential effects on Guadalupe Bass recruitment as a result of a catastrophic flood.

7

Methods for Establishing Flow-Ecology Relationships Useful for Validating Environmental Flow Standards for Texas Rivers

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Keywords: environmental flows, Smallmouth Buffalo, Shoal Chub, Threeridge, boxelder, cottonwood, black willow, Guadalupe River, Colorado River, Brazos River

As part of the adaptive management process for validating environmental flow standards for Texas rivers, our team investigated ecological indicators, state-based and rate-based analytical methods, including retrospective analysis of survey data to assess recruitment dynamics of fish, mussels and riparian trees. Analysis of fish datasets for the Brazos, Colorado and Guadalupe rivers revealed little evidence that local assemblage structures were directly correlated with antecedent flow conditions; however, results from statistical models identified flow components and candidate species and locations that may reveal flow-ecology relationships. By analyzing growth rings in fish otoliths, mussel shell cross-sections and tree cores, we were able to back-calculate dates of fish hatching, initiation of the free-living stage of mussels, and tree germination. Smallmouth Buffalo (*Ictiobus bubalus*) was identified as a good model to investigate interannual recruitment, with duration of high flow pulses during their spawning season critical for success. Model results indicated that recruitment of Shoal Chub (*Macrhybopsis hyostoma*), a relatively short-lived minnow with broadcast spawning and drifting eggs and larvae, is responsive to the frequency and timing of smaller flow pulses. Recruitment of mussels (*Amblema plicata*) was responsive to high flow conditions as well as drought. Among riparian trees, probability of germination in boxelder (*Acer negundo*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*) was positively correlated with spring flow pulses that meet or exceed current e-flow standards, as well as summer flows for boxelder. Longer duration of spring high flow pulses had a positive effect on germination of boxelder and cottonwood, and shorter flow durations at higher tiers has a similar effect. We then modeled probabilities of boxelder germination in response to projected flow scenarios. Our approach assessing effects of hydrology on recruitment success across diverse indicator taxa has great potential to inform environmental flow standards and water resource management.

8

A 70-Year Regional Perspective of an East Texas Urban Fishery

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Keywords: Banita Creek, urban fish community

Few streams are more closely intertwined with urbanization than the Lanana-Banita Creek complex and the city of Nacogdoches in East Texas. We reviewed databases containing fish study surveys spanning a 70-year perspective in this stream complex. Particularly, we focused on surveys conducted in 1950, 1990, 1998, 2010, and 2017-2021. We compared fish assemblage trends over time with the samples of Linam et al. (2002), for the South Central and Southern Humid Region, where they regionally tuned Karr's Index of Biotic Integrity (1986) for Texas wadeable streams. On average, the Lanana-Banita complex had 22 species (range 17-25) for surveys from 1990-2021. Historic surveys from 1950 (Dickens) had far lower diversity with Lanana-Banita yielding 10 and 11 species, respectively. Fishing gear and standardized sampling protocol could be suspect given the paucity of percids collected. The influx of four native invader species in contemporary collections also accentuates the disparity. Cyprinids were the richest family in the Linam et al. study, with centrarchids following closely in their least-disturbed streams. A similar ratio was observed by Dickens in Lanana-Banita historic samples, while contemporary surveys (1990-2021) equalized the cyprinid-centrarchid ratio at 12 species each. Observed species shifts, although not profound, imply that habitat changes due to increased urbanization may be responsible. Linam et al. noted their highest cyprinid stream yields at 7-8 species, which were often surpassed in Lanana-Banita samples. Our comparisons suggest that more species-by-species examination is needed as the decline of key cyprinids and catostomids may be cryptic in richness counts where native-invading species augment totals. It is important to decipher in this oft-overlooked region of Texas, where the state's most diverse fishery may have the most to lose in the face of future urban expanse.

9

Integrating Habitat and Fisheries-Independent Data to Describe the Effect of Sediment Type on Marine Communities in Texas Estuaries

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Keywords: sediment, Upper Laguna Madre, Baffin Bay

Habitat data are rarely integrated into fisheries management decisions but will need to be incorporated more as ecosystem-based management becomes commonplace. Sediment type is one habitat component that is known to influence estuarine communities along the Texas coast. Understanding the influence of sediment type on marine communities will likely become more pertinent as alterations, including dredging and erosion, become more frequent. Here, we integrate a long-term fisheries independent dataset with a concurrent habitat dataset (each collected by Texas Parks and Wildlife Department) to compare the effect of sediment type on community composition from 2018-2021. Differences in community structure were examined across sediment types (clay, silt, sand) within the Upper Laguna Madre (ULM, including Baffin Bay) and Baffin Bay separately using multivariate analyses (PERMANOVA, SIMPER and SIMPROF). In addition, species richness, evenness and diversity were compared across sediment types using ANOVA for both the ULM and Baffin Bay. Significant

differences in community composition were found between all sediment types within the ULM. However, in Baffin Bay, significant differences were only found between silt-sand and clay-sand. SIMPER results indicated that similar species including Sheepshead Minnow, Silverside and Pinfish, consistently contributed to the differences in community between sediment types. In addition, SIMPROF results defined groups of species that responded similarly to sediment type within both bays. Analyses of diversity across sediment types yielded increased richness on silt habitat for the ULM and sand habitat for Baffin Bay. These results suggest that sediment type heavily impacted marine community composition and impacts varied across spatial scales. Fisheries managers could utilize these results to inform decisions related to dredging or other sediment altering activities.

10

Taxonomic and Morphological Diversity of Fish Assemblages in the Big Cypress Creek, Texas.

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Keywords: Big Cypress Creek, Prairie Creek, Ironcolor Shiner, Spotted Sucker

Studying fish assemblages in virtually undisturbed ecosystems can provide a baseline for understanding natural environmental filters of fish communities and maintaining diversity for environmental protection. We investigated the spatial variation of fish assemblages in lentic and lotic freshwater systems directly or indirectly connected to the Big Cypress Creek (BCC), a stream that was considered the main river source. The Big Cypress Creek is located within the Cypress River Basin of Northeastern Texas, and it is virtually undisturbed by anthropogenic activities. We examined taxonomic diversity of fish assemblages at six sites which included streams, ponds and lakes, and measured morphological traits of fish to make inferences in the functional diversity of these assemblages. Fish were collected using different fishing gears. Overall, 35 species contained in 10 Families were collected. The Prairie Creek (PC), the closest stream to the main BCC contained the greatest taxonomic richness (28 species), diversity (Shannon = 2.4), morphological diversity, and species appeared more evenly distributed (Evenness = 0.89) compared to other sites. The PC had ~ 80% of the total number of species collected across all sites. Among the lentic systems, one lake (Brusky Lake) had the highest taxonomic richness (19 species). Streams directly connected to the BCC had a high redundancy of species shared compared to pond and lakes without direct connectivity to the BBC. Our findings corroborate 31 of the species already reported for the Big Cypress basin. In addition, we reported four species that were not previously reported including *Lepomis humilis*, *Ictalurus furcatus*, *Pomoxis annularis*, and *Notropis chalybaeus*. Two species collected in this study, the Ironcolor Shiner (*N. chalybaeus*) and Spotted Sucker (*Minytrema melanops*) are currently listed as species of greatest conservation need in Texas, therefore our findings will be useful for management and conservation purposes of fish biodiversity in the Cypress River basin.

11

Does Spatial Location Matter When Estimating Stream Fish Richness? A Test of Spatially Constrained Rarefaction in the Colorado River Basin, Texas

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Keywords: sample-based rarefaction, spatially constrained sample-based rarefaction, Colorado River

The Colorado River Basin is the third largest river basin in Texas. The river is used to provide water for manufacturing plants, farm irrigation and municipal use in several major metropolitan areas. As population growth in the area continues and water demand increases, it is important to understand the biodiversity of the basin in order to assess ecosystem health and make management decisions in the future. From June to September of 2021, we collected fish community data from 102 sites along the Colorado River mainstem and its tributaries: the Concho, San Saba, Llano, and Pedernales rivers. We conducted ten 5-meter seine hauls at each site (i.e., 1,020 hauls) and recorded global positioning system coordinates for each sampling location. We compared species accumulation curves from traditional sample-based rarefaction (SBR) and spatially constrained sample-based rarefaction (sSBR) methods using the Measurement of Biodiversity package in R ('mobr'). Our sampling detected 45 species within the study area and both rarefaction methods indicated we reached asymptotic richness at 80 sampling sites. The accumulation curve based on SBR method approached the asymptote over a smaller number of sampling sites compared with the sSBR method. For example, at 30 sampling sites the estimated number of species present was 40 using SBR, but 33 using sSBR. Our results suggest assuming random distribution of fishes across a study area might inflate (i.e., overestimate) species richness at a given sampling site. We hypothesize this is because fishes show strong longitudinal gradients in community composition across even intermediate size streams such as those studied here. Thus, spatial location is an important consideration when species richness is a focus of conservation and management planning, such as surveying biodiversity, designing native species conservation areas, or tracking ecological responses to broad-scale habitat restoration.

12

Functional Diversity of Fish Communities Across Environmental Gradients in East Texas Streams

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Keywords: functional traits, environmental gradients, East Texas, functional richness

Stream communities are structured by environmental processes that vary in strength across different spatiotemporal scales. Therefore, revealing the relationship between species functional traits and local environmental habitat may clarify how communities respond to disturbance associated with anthropogenic change. Surveys of local habitats and fish assemblages were conducted at 75 stream sites within five river basins of East Texas from April to October of 2020-2021. We measured 29 functional traits related to foraging, mobility, and habitat use in five adult individuals of each fish species collected and examined their associations with local habitat parameters. We used mean-nearest neighbor distance (MNND), standard deviation of nearest-neighbor distance (SDNND), and functional richness (FRic) to examine the relationship between assemblage functional diversity and species richness. Principal component analysis (PCA) performed on local habitat variables among stream sites suggested a gradient

of variation influenced by substrate composition, riparian characteristics, flow regime, and instream habitat. A PCA performed on morphological traits revealed a gradient related with performance (e.g. body depth, body width) and trophic ecology (e.g. head depth, gill raker length, eye diameter). MNND and SDNND tended to decrease as species richness increased, suggesting fish communities were more packed, and more even with increasing species richness. FRic tended to increase as species were added, but FRic peaked in assemblages with intermediate species richness. Our findings provide insights into how environmental gradients influence the functional diversity of fish assemblages in East Texas streams.

13

Using a Bottom-Up Isotopic Approach to Establish Baseline Data on an Estuarine Food Web System in Matagorda Bay, Texas

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Keywords: stable isotopes, Matagorda Bay, food web, primary production

Understanding food web structure and integrity is essential in establishing baseline ecological information for estuarine ecosystems susceptible to fisheries and substantial anthropogenic effects, particularly in systems under minimal anthropogenic influence. Matagorda Bay is the second largest, wind-driven estuary along the Texas coast and features key habitats home to high marine biodiversity and productivity. While Matagorda Bay encompasses a wide range of commercial and recreational interests, the bay is relatively undeveloped by anthropogenic activities. Therefore, quantifying baseline data is critical to the development of effective ecosystem management and conservation strategies for valuable estuarine habitats and consumers susceptible to future anthropogenic influence. Because of the spatial and physical complexities of estuaries, it is difficult to quantify the relative importance of differing sources of primary production (i.e., phytoplankton, benthic microalgae, vegetation) that support estuarine consumers. Stable isotope methods have proven to be a useful tool to delineate energetic pathways within a food web by providing long-term measures of diet to examine the complex relationships between producers and consumers. While $\delta^{13}\text{C}$ values reflect contributions from different primary producers, $\delta^{34}\text{S}$ values can further distinguish spatial influences by reflecting a fresh or marine water influence. Additionally, $\delta^{15}\text{N}$ values are used to determine trophic level, particularly when primary producer $\delta^{15}\text{N}$ values are known and can provide a baseline. Therefore, this study aims to use a bottom-up approach to quantify $\delta^{13}\text{C}$, $\delta^{34}\text{S}$, and $\delta^{15}\text{N}$ isotope values for dominant primary producers and consumers within the Matagorda Bay estuarine food web. Sampling occurred seasonally over two years, throughout the extent of the bay to capture a large temporal and spatial scale. By establishing baseline information, this study will provide an improved understanding of the functional roles and linkages between primary production among the habitats and species that inhabit them.

14

Applying Effects of Sub-Lethal Stress to Fisheries Management: A Focus on Coastal Recreational Species

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Keywords: sub-lethal stress, hypoxia, methylmercury, Red Drum, Southern Flounder, Atlantic Croaker

Protecting resiliency of ecosystems will require understanding not only impacts of lethal stressors but also how “sub-lethal” stress alters dynamics of communities, populations, and individuals. Focusing on three important recreational fish species in Texas, I propose to examine long-term effects of sub-lethal stressors on the resource use of fish in two coastal ecosystems with different types of stressor frequencies and intensities. Specifically, this project will explore the effects of hypoxia and methylmercury accumulation on Red Drum (*Sciaenops ocellatus*), Southern Flounder (*Paralichthys lethostigma*), and Atlantic Croaker (*Micropogonias undulatus*) to assess any potential changes in condition factor, isotopic niche, individual specialization, and trophic structure. Work will include several analyses of variance and modeling to assess the effect of stress exposure on isotopic niche variation at the individual level using eye lenses, at the population level using muscle and between species, in addition to condition factors and growth at age for the fish. Understanding how stressors affect fish at the individual level, population level, and community level will improve ecosystem-based management models and better protect these fish fisheries in light of the changing coastal ecosystems.

15

A Trip Up the Tributary: Affluent Streams Provide Floodplain Access for Alligator Gar in a Regulated River

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Keywords: Alligator Gar, Brazos River, Tributary connectivity

Access to floodplain habitat is critical for successful recruitment of large river fishes such as Alligator Gar. However, it is possible that lateral connectivity to tributaries is essential for Alligator Gar persistence in regulated mainstem rivers where floodplains are largely inaccessible because of upstream flood control structures. Despite these phenomena, few studies have investigated Alligator Gar movements between mainstem and tributary habitats in regulated rivers. We surgically implanted transmitters in 44 adult Alligator Gar in 2020 and 2021 and tracked their movements using stationary and mobile receivers to explore the idea that Alligator Gar access flooded habitats through tributaries. Our study area encompassed a 366-km section of the Lower Brazos River, including 200 km of mainstem river and 166 km of tributary streams (i.e., Little River, Navasota River, and Yegua Creek). In total, 259 manual relocations and 132,560 stationary detections were observed during the study. Home ranges of individual Alligator Gar averaged 25 river km but ranged 1-155 km among individuals, and 26 of the 44 fish transitioned between mainstem and tributary habitats. We modeled mainstem river discharge, water temperature, and fish sex effects on Alligator Gar occurrence in tributaries using generalized linear mixed effects regression applied to the stationary receiver detection data. The fixed

effects of temperature and discharge was significantly related to tributary occurrence of Alligator Gar and revealed that the majority of individuals were found in tributaries when temperature was warmer and flow was higher; two conditions that generally meet requirements for Alligator Gar reproduction. Results from this study suggest that tributary connectivity might be beneficial for Alligator Gar population persistence and our work has implications for other migratory fishes with similar life histories living in regulated mainstem rivers worldwide.

16

Population Structure and Demography of the Alligator Gar

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Keywords: Alligator Gar, haplotypes, mitochondrial DNA

The Alligator Gar (*Atractosteus spatula*) is a large, predatory fish inhabiting the river systems of the central and lower Mississippi River Valley and the Gulf Coastal Plain. The Alligator Gar is a conservation concern for state fish and wildlife agencies because of historical population declines and range contractions, its role as an apex predator, and its importance as a trophy game fish. Conservation efforts can be enhanced by understanding the target species population structure; therefore, we undertook a range-wide assessment of the phylogeographic structure and demographic history of the Alligator Gar using mitochondrial DNA. We observed 31 haplotypes. Median-joining network revealed that Alligator Gar haplotypes clustered into three haplogroups: haplogroup A was widespread and occurred in all sampling locations, haplogroup B was abundant in coastal locations, and haplogroup C was restricted to Texas from Matagorda Bay southward. Results of analysis of molecular variance revealed significant amount of genetic variation was due to differences among regions and among populations within regions. Mismatch distributions indicated that Alligator Gar have undergone rapid population expansion in the recent past. Its phylogeographic structure suggests that the Alligator Gar was formerly isolated in three refugia during the last major glaciation and the current geographic overlap of the three haplogroups is largely the result of post-Pleistocene range expansion. Regional population structure is probably the result of the combined effects of Pleistocene range fragmentation, isolation by distance resulting from range expansion, and contemporary dispersal barriers. Phylogeographic and regional population structure suggest the existence of local genetic adaptation. Efforts to reestablish or supplement populations of Alligator Gar should consider genetic population structure when selecting potential donor stock to ensure that transplanted individuals have the greatest potential to survive and reproduce.

17

Alligator Gar Population Connectivity and Habitat Use in the Trinity River National Wildlife Refuge

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Keywords: Alligator Gar, Trinity River, floodplain connectivity

Variability in river-floodplain connectivity is an important driver of Alligator Gar (*Atractosteus spatula*) recruitment. For example, recent research on the Trinity River, Texas, modeled year class strength as a function of flow-dependent availability and accessibility of suitable spawning habitat. Those analyses also indicated importance of floods late in the spawning season, which may reflect late season spawning, improved quality of floodplain habitats, and/or fluvial connectivity that allows juveniles to move from off-channel habitats into the main river. It is unknown whether off-channel habitats (e.g. oxbows, sloughs) of the Lower Trinity River function as nurseries or whether backwaters primarily function as sinks where individuals are trapped due to lack of connectivity. Effects of fragmentation and fluvial connectivity on habitat quality, movement, habitat use and growth of juveniles in floodplain habitats has not been assessed, but such data could be used to inform restoration and improved landscape management to enhance Alligator Gar stocks. This poster provides an overview of our ongoing research focused on spatiotemporal dynamics of habitat use of off-channel waterbodies of the Trinity River National Wildlife Refuge and adjacent areas, as well as initial results on juvenile Alligator Gar habitat use, length-weight relationships and individual movement determined by passive integrated transponder tagging and monitoring in the Lower Trinity River.

18

Gar Species Assemblages and Abiotic Drivers in Galveston Bay and Sabine Lake

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Keywords: Alligator Gar, Spotted Gar, Longnose Gar, Shortnose Gar

Species assemblages can give insight into community structure and ecological functions of a system, and are influenced by mechanisms and processes like habitat suitability and competition. Understanding how species assemblages change over time is key to conservation and management efforts, as well as understanding how environments are changing due to anthropogenic or climate stressors. Gar (Family Lepisosteidae) are important predators in estuarine systems as they regulate and balance prey fish populations, and act as model indicator species for natural stressors like climate change, freshwater input, and storm events. Due to their native ranges and life history, Texas gar populations face varying fishing pressures depending on region. Due to the nature of the Texas watershed, activities like recreational fishing in an inland area may have negative impacts on coastal communities, especially with species like gar who sometimes utilize the entirety of the watershed from upland rivers to river outputs in estuarine bays. This study aims to qualify and quantify the historic trends in species assemblages of the four species of gar found in Texas: Alligator Gar (*Atractosteus spatula*), Spotted Gar (*Lepisosteus oculatus*), Longnose Gar (*Lepisosteus osseus*), and Shortnose Gar (*Lepisosteus platostomus*). Species assemblages and abundances will be compared to abiotic factors over a forty year time period in Sabine Lake and Galveston Bay to determine ecological relationships and be used as predictive models for abundance and distribution. Utilizing gill-net catch data from Texas Parks and Wildlife's Coastal Fisheries long-term monitoring program, this study aims to analyze seasonal drivers of gar presence and absence. Texas gar populations are a key resource for recreational fishing, and function as apex predators in many ecosystems. Protection of these fish is imperative to support the Texas economy and environment, and this study will improve our understanding of Texas gar populations for management and conservation purposes.

19

Texas Aquatic Bioblitz Initiative: Gap Sampling to Inform Native Fish Conservation Efforts in Texas

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Keywords: Texas Aquatic Bioblitz Initiative, Native Fish Conservation Areas, species of greatest conservation need, Fishes of Texas Project, Biodiversity Center

The Texas Aquatic Bioblitz Initiative has worked over the past nine years to fill critical data gaps in the state's fish distribution dataset with a focus on Texas Native Fish Conservation Areas (NFCAs). The Texas NFCAs Network includes 20 priority watersheds identified as strongholds for the preservation of Species of Greatest Conservation Need (SGCN) and overall freshwater fish diversity throughout the state. An analysis of data gaps using the Fishes of Texas Project helped determine locations for bioassessments and supplemental fish sampling in select NFCAs. Since 2012, twelve watersheds/basins spanning ten NFCAs have been sampled to support this effort. Fish assemblage data have been collected at 352 locations which have documented over 96,000 individuals consisting of 162 species. Specimens are cataloged into the Ichthyology Collection (TNHCi) of the Biodiversity Center at the University of Texas-Austin, and their data immediately published to the publicly accessible Global Biodiversity Information Facility. Later, the same data are also integrated into the public Fishes of Texas Project online database/website. These data have been used to support management plans and interpretive programs at state-owned properties; to document range expansions and reductions of fishes, new records of rarely collected species and a new addition to the state's freshwater fish checklist; and to help refine SGCN and State Threatened and Endangered species lists in Texas. Additionally, data from these efforts have supported multiple conservation efforts including the development of instream flow needs in northeast Texas, Guadalupe Bass restoration in Central Texas, and an updated status assessment of prairie minnows in North Texas. This project has been extended through 2024 with plans to conduct five more bioassessment and gap sampling events to fill additional data gaps in remaining NFCAs in Texas.

20

Wood is Good: Assessing Habitat Associations of Alligator Gar in the Lower Brazos River using Side Scan Sonar

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Keywords: woody debris, Alligator Gar, Brazos River, side-scan sonar

In recent decades, studies investigating Alligator Gar ecology have aided our understanding of the species and driven conservation and management. However, the majority of these studies focused on movement, age and growth, and recruitment with less focus on basic habitat needs. In particular, the use of habitats composed of deposited woody material might have implications for terrestrial habitat management near rivers occupied by Alligator Gar. In order to fill this knowledge gap, we studied habitat associations of Alligator Gar using individuals fitted with acoustic transmitters to assess habitat use and side scan sonar to assess habitat availability. We surgically implanted transmitters in 44 adult

Alligator Gar in 2020 and 2021 and relocated these individuals within 10 m using manual telemetry monthly for the duration of the study (April 2020 - August 2021). Side scan sonar surveys were implemented in areas where high densities of Alligator Gar relocations occurred in the Brazos River and Navasota River. We looked at a 43-km section of the Brazos River, encompassing an area of 3.3 km², where 16 of the 44 individuals were relocated amounting to 86 relocations. Side scan recordings were digitized with polygons around coarse woody debris. Habitat selectivity was determined using a 10-m buffer around each individual relocation. Selectivity and avoidance of woody debris were analyzed using Jacob's Electivity Index (scaled from -1 to 1) where 1 indicates total preference and -1 indicates total avoidance. This analysis revealed strong selectivity towards woody debris (Jacob's Electivity Index = 0.967) where 19 out of 86 relocations were found within 10 m of woody debris. Our study further highlights the importance of lateral connectivity (i.e., river channel to floodplain) in rivers inhabited by Alligator Gar by demonstrating that woody debris deposited from the floodplain and riparian zone into the river channel is used by gar.

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Assessing the Restored Guadalupe Bass Population in the Mission Reach, San Antonio

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Keywords: Guadalupe Bass, Largemouth Bass, San Antonio River

The Guadalupe Bass, *Micropterus treculii*, is a species of greatest conservation need found in streams draining the Edwards Plateau in Central Texas. In 2015-16, Texas Parks and Wildlife Department reintroduced Guadalupe Bass to a 16.9 km reach of the upper San Antonio River that had been restored from homogenous artificial channel to pool-riffle habitat complexes in 2013 by the San Antonio River Authority. Our objectives were to estimate relative abundance, microhabitat use, and population size of both Guadalupe Bass and Largemouth Bass, *Micropterus salmoides*, in the restored reach. Eight uniformly distributed sites were selected for this study, five of which were wadeable pool-riffle units and three of which were non-wadeable pools. Fish sampling was conducted in July and October 2021 in each site using boat or backpack electrofishing, with microhabitat recorded for each fish capture location. In July, a total of 72 Guadalupe Bass (44-341 mm total length) and 162 Largemouth Bass (50-546 mm) were captured. In wadeable sites, catch-per-unit-effort (CPUE, number of fish/h) averaged 7 ± 2 (SE) Guadalupe Bass/h. In non-wadeable pools, CPUE averaged 8 ± 1 Guadalupe Bass/h and 30 ± 8 Largemouth Bass/h. Guadalupe Bass occurred more frequently in microhabitats with shallow depth (68.9 ± 37.7 cm), higher velocity (0.3 ± 0.5 feet/sec), and larger mean substrate diameter (447.5 ± 263.6 cm) compared to Largemouth bass. Capture locations of Largemouth Bass had greater mean depth (114.6 ± 46.2 cm), slower velocity (0 ± 0.1 feet/sec), and smaller substrate diameter (263.5 ± 290.2 cm). Results indicate that Guadalupe Bass and Largemouth Bass segregate along lotic-lentic gradients in the restored reach. Project objectives will continue to be addressed in 2022 by additional fish and associated microhabitat sampling (January, April) and a capture-mark-recapture study (March). The results of this study will help inform conservation and management of this unique urban population of Guadalupe Bass and may be used to justify additional stream restoration and Guadalupe Bass introduction efforts.

22

Mapping and Initial Characterization of East Bank Ridge, Gulf of Mexico, to Determine Current State, Fish Community, and Impacts of Illegal Fishing Practices

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Keywords: East Bank Ridge, illegal fishing

East Bank Ridge is a natural reef formation located 18 nautical miles off the coast of South Padre Island, extending into Mexico. On the U.S. side, this formation spans an area of over 80 km² at 40-45m depth. Little is known about the structural composition or biological community present on this ridge. A decade ago, the ridge was well-known in the South Padre Island fishing community as a site for prized fish species (primarily Serranidae and Lutjanidae sp.). Currently, the area is no longer frequented by fishermen because catch rates have decreased substantially according to their personal observations. Apprehensions due to illegal fishing practices have increased substantially in the last five years in this area, primarily in close proximity to the Mexican border. In this study, we aim to characterize the current habitat and fish populations present at East Bank Ridge and identify possible sources of degradation. A base map of the structures present at East Bank Ridge will be created using side scan sonar to identify major structures that could provide suitable habitat for reef fish species. Mapping will also be used to identify any damage caused by human activities. Select sites will be visually surveyed using a remotely operated vehicle (ROV) to determine fish community composition and identify potential scarring. Additionally, sediment samples will be taken to assess sediment characteristics and age of the structures. Interviews of local, long-term fisherman and shrimpers will be conducted to provide a baseline of historic fish presence to compare to current species presence. Records of apprehensions for illegal fishing practices will also be assessed to determine prevalence and time scale of these practices in the area.

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Conceptualization, Design, and Implementation of Texas Parks and Wildlife Department's Habitat and Angler Access Program

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Keywords: Habitat and Angler Access Program

Texas Parks and Wildlife Department (TPWD) is responsible for managing freshwater fisheries resources in over 1,100 reservoirs and small impoundments in addition to 191,000 miles of streams, creeks, and rivers in the state. Many of these systems have suffered declines in habitat quantity and quality associated with land and water use patterns; and the state's rapid population growth has led to increased pressure on currently available public access fishing locations. To address current and emerging needs for fish habitat conservation and restoration and the increasing demand for angler access in these systems, TPWD allocated funds generated from freshwater fishing license revenues to develop and support the Habitat and Angler Access Program (HAAP). The HAAP was established to support freshwater fish habitat restoration and enhancement efforts as well as shoreline-based angler access projects. The HAAP was conceptualized with two funding allocation mechanisms: a competitive grant program that supports projects led by external partners and an internal funding stream supporting

habitat and access projects proposed by TPWD fisheries biologists. Successful development of the HAAP required establishing a framework that would a) address established fish habitat and angler access priorities, b) be supported among TPWD staff, c) follow protocols congruent with other successful TPWD grant programs to effectively allocate resources, and d) efficiently deliver outcomes (high quality habitat and access) to meet program objectives. A workgroup of TPWD fisheries biologists was tasked to develop the external grant framework that included drafting a request for proposals (RFP), proposal scoring system, project selection process, and regulatory compliance documentation. In addition, the workgroup facilitated a statewide needs assessment to identify thematic funding needs and priority shovel-ready projects for the internal funding stream. This discussion highlights the development of the HAAP framework and its implementation as well as challenges encountered, strategic priorities, projects selected for funding through the initial funding cycle, expected outcomes, and anticipated future steps of the program.

24

Environmental Niche Modelling and Mapping of Invasive Virile Crayfish in the Lower Colorado River Basin

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Keywords: virile crayfish, Colorado River Arizona, Environmental Niche Model

The Lower Colorado River Basin of Arizona (LCRB) is invaluable to freshwater biodiversity, harboring an endemic fish fauna that includes 28 Species of Greatest Conservation Need (SGCNs). Over the last forty years, non-native virile crayfish (*Faxonius virilis*) have become established in waterbodies of the LCRB, outcompeting and preying upon native fishes. However, their invasion potential, and thus possible distribution remains poorly understood. This study addresses two questions: (1) what is the environmental niche of virile crayfish, and (2) what is the geographic distribution of virile crayfish in the LCRB? We conducted a geographically comprehensive field survey across 108 wadeable stream sites in the LCRB in the summer of 2021 to assess site occupancy of virile crayfish, developed environmental niche models to characterize habitat suitability, and projected habitat suitability to all 100,237 interconfluence stream reaches in the LCRB. We fit Environmental Niche Models (ENMs) via Generalized Linear Models (GLMs) and Random Forests using nine GIS-derived natural and anthropogenic landscape predictor variables. We used Area Under the Curve (AUC) to evaluate model performance, Gini index to evaluate variable importance, and partial dependence plots to evaluate relationships between predictors and habitat suitability. We captured 10,520 crayfish in 70 of the 108 sites. AUCs were 0.82 and 0.85, for the GLM and Random Forest, respectively. Topological wetness index, percent forest, and human population density within watershed were the strongest predictors, whereas density of georeferenced dams and percent agricultural land use within the watershed were relatively weak predictors. ENMs predicted crayfish presence in 50.5% of perennial streams and 8.4% of intermittent streams. Habitat suitability was greatest in perennial streams in high elevation forests. The GIS layers from this ENM will aid conservation efforts by providing occurrence estimates at the fine spatial resolution needed to prioritize eradication and restoration based on co-occurrence with imperiled native species.

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Movement and Mortality of Invasive Suckermouth Armored Catfish During a Spearfishing Control Experiment

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Keywords: spear fishing, suckermouth armored catfish, San Marcos River, invasives

Control of non-native, invasive species in groundwater-dependent ecosystems that are also inhabited by regionally endemic or at-risk species represents a key challenge in aquatic invasive species management. Non-native suckermouth armored catfish (SAC; family Loricariidae) have invaded freshwater ecosystems on a global scale, including the groundwater-dependent upper San Marcos River in Texas, USA. We used passive integrated transponder tags to follow the movements and fates of 65 fish in a 1.6 km spring-fed reach of the upper San Marcos River to assess the efficacy of a community based spearfishing bounty hunt for controlling SAC. We found the weekly probability of SAC survival was negatively correlated with the number of fish removed as a part of the bounty hunt each week ($P = 0.003$, $R^2 = -0.86$), while the probability of SAC being speared and reported was positively correlated with the number of fish removed ($P = 0.011$, $R^2 = 0.53$). The majority of SAC used $<25 \text{ m}^2$ of river over a nine-week tracking period, but the area of river fish used correlated positively with the number of relocations ($P < 0.001$, $R^2 = 0.38$) as might be expected for a population that disperses through diffusive spread. These findings collectively suggest local-scale suppression of the SAC population is possible through community engagement in spearfishing, but over longer time periods immigration might offset some of the removal success. This conclusion provides an explanation for the pattern in which long-term spearfishing tournaments have reduced biomass but ultimately not resulted in eradication of the population.

26

Response of Biological Communities to Invasive Giant Reed (*Arundo donax*) Management in the Pedernales River Headwaters

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Keywords: giant reed, Barons Creek, invasive

Giant Reed (*Arundo donax*) is a non-native, cane-like perennial grass that can grow prolifically along riparian corridors. Invasion can negatively influence aquatic systems by displacing native riparian plants that stabilize banks, degrading habitat quality for biotic communities, and altering channel geomorphology. Barons Creek is a predominantly urban stream in the upper Pedernales River watershed with a moderate degree of intact native riparian vegetation but historically high levels of Giant Reed infestation. In an effort to reduce negative impacts of this invasive species, a multi-watershed scale effort to control Giant Reed in the Texas Hill Country using herbicide treatments was initiated in late 2015. This study aims to understand the effects of Giant Reed control efforts on biological communities and physical stream habitat and evaluate native riparian plant restoration. Three study sites were

selected in the upper, middle, and lower reaches of Barons Creek in Fredericksburg, TX. Baseline sampling was conducted prior to initiation of management efforts in 2016. Annual sampling from 2016-2020 included water quality, discharge, channel geomorphology, riparian plant community response, and fish and benthic macroinvertebrate community composition. This poster focuses on the biological data components, including fish and invertebrate communities and riparian plant recolonization in treated Giant Reed patches. Continued monitoring and a better understanding of long-term outcomes will be valuable to natural resource managers engaged in Giant Reed management to enhance watershed-scale conservation efforts.

27

Ecological Niche Similarities Between Native (*Cyprinodon rubrofluviatilis* and *Fundulus zebrinus*) and invasive (*C. variegatus* and *F. grandis*) Cyprinodontids in Texas Streams: Evidence from Morphology, Diet, and Stable Isotope Analysis

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Keywords: invasives, stomach contents, stable isotopes, Red River Pupfish, Plains Killifish, Sheepshead Minnow, Gulf Killifish, Brazos River, Red River

Biological invasions have occurred worldwide with significant ecological, evolutionary, and economic impacts on recipient ecosystems. Researchers now have access to a combination of approaches to better identify the risks and potential ecological impacts in recipient communities. Here, we used an integrative approach based on morphological traits, stomach contents, and stable isotope ratios ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) to examine multiple dimensions of the niche of native Texas Cyprinodontids (*Cyprinodon rubrofluviatilis* and *Fundulus zebrinus*) and their invasive congeners (*C. variegatus* and *F. grandis*). We analyzed specimens collected during multiple surveys in the Brazos River and Red River basins from 2009-2021. Because of their morphological similarities, we predicted high overlap in the dietary and habitat niches between native and invasive congeners. A principal component analysis performed on 24 morphological traits associated with habitat use, morphology and performance suggested high overlap in morphological space occupied by the two *Cyprinodon* species, but low overlap between the two *Fundulus* species. High overlap on dietary and isotopic niche space was observed for *Cyprinodon* and *Fundulus*, both native and invasive congeners. Values of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios revealed that the native and invasive *Cyprinodon* species occupied virtually identical isotopic niches, while *Fundulus* showed slight differences. Similarities in the feeding ecology between Cyprinodontid, both native and invasive, could lead to negative ecological interactions such as competition for food resources, while similarities in morphology, as observed between native and invasive *Cyprinodon* species could influence fitness (i.e., via hybridization) of native populations. A combination of approaches as used in this study is a useful framework to better quantify the potential ecological impacts of invasive species in recipient communities.

28

Characterizing the Thermal Niche of Mexican Tetras (*Astyanax mexicanus*) Using Physiological Laboratory Assays

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Keywords: Mexican Tetra, thermal physiology

The Mexican Tetra (*Astyanax mexicanus*) is native throughout northeastern Mexico and southern Texas and is one of the few tropical-originating species native to the United States. The Mexican Tetra has established populations north of its native range, but there is limited research on the thermal physiology of Mexican Tetras. This precludes understanding of the physiological limits that may inhibit or facilitate northward expansion in future climate. To address this knowledge gap, temperature dependent assays were conducted in a laboratory to measure respiration and consumption, at temperatures of 8, 14, 20, 26, and 32°C. Intermittent-flow respirometry was used to measure oxygen consumption rates during 4-hour assays. During consumption assays, fish were fed ad libitum bloodworms (Chironomidae) for 24 hours and consumption was measured by the remaining count of bloodworms. Brier functions were used to quantify the non-linear relationship between temperature and each response variable. Respiration increased exponentially at temperatures ranging from 14 to 32°C. Consumption ceased at temperatures below 8.0°C and above 32.0°C and reached a maximum at 26°C. Thermal optimum for consumption was about 1.5°C higher than optima found in temperate-originating species, matching expectations based on realized climatic niches. Data from this study can be applied to develop a bioenergetics growth model for the Mexican Tetra, being one of the few models to be developed on a freshwater tropical species. These physiological limitations can be used to infer thermal niche dimensions and subsequent opportunities for northward range shifts in the wake of climate change. These range shifts could alter species interactions with native fauna at the northern range edge and may inhibit persistence of Mexican Tetras at their southern range edge. Influences of climate change on the Mexican Tetra can serve as a model study system for other tropical species and invaders within the United States.

29

Genomic Population Structure of the Eastern Oysters (*Crassostrea virginica*) in the Gulf of Mexico

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Keywords: Eastern oysters, oyster mariculture, Gulf of Mexico

Eastern Oysters (*Crassostrea virginica*) are found from the Gulf of St. Lawrence to Venezuela and based on previous studies, are composed of several distinctive genetic populations throughout their range. Oysters are a commercially and ecologically important species that have experienced recent declines coastwide. Recently, several states bordering the Gulf of Mexico (including Texas) have begun to pursue regulatory frameworks for inshore oyster mariculture operations, in order to relieve some of the pressure on wild stocks in the context of growing commercial demand. To balance management between the fishery and the culture industry, it would be helpful to define management units (or from a biological standpoint, independent populations) of oysters from the Gulf of Mexico. Here, restriction-

site associated DNA sequencing was performed on individuals from 17 bays distributed from Florida to Texas, resulting in 1,337 SNP loci genotyped in 451 individuals. A principal component analysis of this data indicated three distinctive populations (eastern, northern, and western), and a bayesian cluster analysis (Structure) indicated that Apalachicola Bay, Florida Bay, and Corpus Christi Bay, Texas were hybrid zones. In comparison to a previous study in our lab, the Texas hybrid zone seems to have moved southward. These data indicate complex population structure of Eastern Oysters in the Gulf that is consistent with previous findings, and the potential for a dynamic hybrid zone in Texas. We discuss the implications for sustainability of wild oysters in the Gulf of Mexico in the face of intensive fishing pressure and a burgeoning oyster mariculture industry.

30

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

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Keywords: Eastern oyster, stable isotopes, Mission-Aransas National Estuarine Research Reserve, stress events

Bivalve biological engineers such as the Eastern oyster, *Crassostrea virginica*, provide essential ecosystem services such as improved water quality by filter feeding and habitats for many fishes and invertebrates through their reef-building capabilities. The impact of protracted or abrupt stress events in estuaries such as droughts and floods on the resilience of oysters must be quantified to successfully manage this ecologically and economically valuable resource. To reconstruct individual stress histories for oysters, archived oyster shells from two previous studies conducted within the Mission-Aransas National Estuarine Research Reserve will be used for geochemical analyses of sequential subsamples across shell growth increments. Reconstructed, reef-specific stress histories will be generated using stable isotope and elemental/Ca analyses. Dependent upon environmental shifts and how these reflect in the microchemistry, a stress response and mitigated metabolic growth can be proposed given prior knowledge of how certain fluctuations in these proxies reflect physiological processes. These chemical analyses coupled with calculated oyster condition indices together provide a powerful tool to reveal carry-over impacts of stress on oyster performance under environmentally variable conditions. Identifying the extent to which oysters are physiologically able to withstand stress events, such as dramatic salinity shifts due to freshwater inflows or drought periods, is critical to predict their future resilience to environmental change.

31

Freshwater Mussel Community Composition and Population Demographics of ESA-Candidate *Pleurobema riddellii* in an East Texas Canal System

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Keywords: Lower Neches Valley Authority, canals, *Pleurobema riddellii*

The Lower Neches Valley Authority (LNVA) canal system diverts water from the lower Neches River, Pine Island Bayou, and the lower Trinity River through approximately 965 kilometers of canals to

municipal, industrial, and agricultural users in multiple counties of southeast Texas. In spring 2021, we surveyed 24 sites in canal segments of the LNVA system with varying flow regimes (i.e., perennial and intermittent) using a combination of timed survey methods. During 80 person-hours (p-hr) of survey effort, 11,200 mussels represented by 21 species were collected, including ESA-candidate *Pleurobema riddellii* (Louisiana Pigtoe). Mussel assemblages in perennial canals were more diverse and had higher catch rates compared to intermittent canals, suggesting flow permanence has a large effect on structuring this canal system's mussel community. *Pleurobema riddellii* were documented at 58% of sites surveyed and ranked second among species in total abundance (1,984 individuals [ind]) and mean catch-per-unit effort (20.76 ind/p-hr). At perennial canal sites, mean *P. riddellii* catch rates (29.18 ind/p-hr) were considerably higher than those observed during recent survey efforts in natural riverine habitats (0.00 – 8.75 ind/p-hr). Observations of gravid females and presence of individuals as small as 16 millimeters in length suggest successful spawning and recent recruitment in this population. Further research on *P. riddellii* within the LNVA canal system will provide an opportunity to inform conservation and management efforts of this species in natural riverine systems.

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A Comparison of Hydraulic Tongs and Dredges for Monitoring Oyster Reefs in the Mission- Aransas Estuary

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Keywords: oysters, Mission-Aransas, oyster dredge, tongs

The Eastern Oyster (*Crassostrea virginica*) is an organism with high economic and ecological importance to the coastal bend of Texas. Oysters are both a foundation species and an ecosystem engineer, providing protection to bays and shorelines from erosion and providing habitat for estuarine organisms. The Texas Parks and Wildlife Department currently uses dredge sampling to assess the catch rate of legal sized oysters (≥ 76 mm) and the percent of undersized oysters (51-75 mm) sampled at the beginning and throughout the commercial season. Together, these metrics are used to open and close areas to commercial oyster harvest. However, dredges have been shown to produce biased sampling data with regard to the sizes of the oysters collected. Here we compared the sampling performance of hydraulic oyster tongs with the performance of the oyster dredges. Sampling was conducted in the Mission-Aransas estuary along six reefs that present varying levels of fishing pressure. Results show that oyster tongs allow us to accurately assess catch per unit area, which can be helpful for more quantitative analysis of oyster abundance. However, tong samples cover a smaller area than dredges, which could increase variability between samples for some reef areas. This increased variability could have sample size implications for tong versus dredge sampling programs. Comparing these two gears will allow us to determine if a change in sampling methodology would benefit the way that oysters are monitored and to better understand the inherent shortcomings that each of these sampling gears and their associate data present to fisheries managers.

33

Distribution and Environmental Preferences of the Gulf Stone Crab (*Menippe adina*) in Texas, 1996-2021

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Keywords: Gulf Stone Crab, Cedar Lakes, East Matagorda Bay

The Gulf Stone Crab (*Menippe adina*) is a commercially valuable Xanthid found in the coastal waters of the Gulf of Mexico from the Florida Panhandle to Tamaulipas, Mexico. Little is known about the recent distributional trends and abundance of this species in Texas. For this study, long-term trends in adult abundance were analyzed using gill net data collected through the Texas Parks and Wildlife Department's (TPWD) Marine Resource Monitoring Program. Coastwide, TPWD collects 780 bi-annual gill net samples each year. Of the sampling gears deployed, adult stone crabs are most frequently encountered in gill nets. Between 1996-2021, there were 2,008 adult Gulf Stone Crabs captured in gill nets coastwide, with the highest catch rates in Cedar Lakes and East Matagorda Bay. Logistic regression modelling suggests that major bay, salinity, temperature, season, and dissolved oxygen were significantly correlated with catch probability, while turbidity was not. Additionally, linear regression modelling suggests that relative abundance of the species has declined over the study period ($p < 0.05$). This could be explained, in part, by declining oyster reef habitat on the Texas coast, as this habitat-type serves as important nursery habitat for the species.

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Mussel Community and Their Habitat Associations in the Sabine River (Texas and Louisiana)

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Keywords: Sabine River, mussels

The Sabine River basin supports 32 native freshwater mussel species, including five state-threatened species. Two of the state-listed species (Louisiana Pigtoe *Pleurobema riddellii* and Texas Heelsplitter *Potamilus amphichaenus*) were proposed as candidate species for USFWS listing. To supplement existing information on the two candidate species, we conducted surveys in upper and lower reaches of the Sabine River (separated by Toledo Bend Reservoir) and in three tributaries to quantify spatial distribution and habitat associations of the mussel community. Individuals ($N = 9,244$), representing 28 species, were documented among 46 sites. Among all sites, state-listed Texas Pigtoe *Fusconaia askewi* was the most abundant species (21% in relative abundance), followed by Pistolgrip *Tritogonia verrucosa* (18%) and Pimpleback *Cyclonaias pustulosa* (14%). Louisiana Pigtoe ($N = 57$, 2.6%) and Texas Heelsplitter ($N = 7$, 0.81%) were taken only from the upper reach of the Sabine River. Mussel species were segregated along a current velocity and substrate gradient. Louisiana Pigtoe, Washboard *Megaloniais nervosa*, and Deertoe *Truncilla truncata* were positively associated with swifter current velocities in riffle and run habitats with gravel substrates, whereas

Louisiana Fatmucket *Lampsilis hydiana*, Round Pearlshell *Glebula rotundata*, and Giant Floater *Pyganodon grandis* were positively associated with slacker current velocities in pool and backwater habitats with silt substrates. Study results provide a basic understanding of mussel habitat associations and can inform additional sampling efforts to detect Louisiana Pigtoe and Texas Heelsplitter within other drainages within the reported range of Louisiana Pigtoe and Texas Heelsplitter.

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Mapping the Map Turtles of the Guadalupe

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Keywords: Cagle's map turtle, Guadalupe River

In June 2021, researchers from Tarleton State University initiated a 4-yr field study of Cagle's map turtles (*Graptemys caglei*), a freshwater emydid species endemic to the Guadalupe River Basin. The study will evaluate current distribution and abundance using occupancy and hierarchical modeling approaches, with new data acquired from bridge point surveys, river transect surveys, and a limited capture-recapture assessment. Over the 2021 field season, we performed 51 point surveys of 40 unique localities and 36 river surveys across 12 unique transects, totaling nearly 200 river kilometers of repeated surveys. Cagle's map turtles represented 500 of 1745 total basking turtle observations from river transect surveys (~29%), with the Texas River Cooter being the dominant freshwater species in the study area. In addition, we have been collecting matching samples of benthic macroinvertebrates, with the purpose of using invertebrate assemblages as a covariate for turtle occupancy and abundance. With this meeting, we hope to network with interested stakeholders to increase river access for a more comprehensive survey of map turtles across the river basin.

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The Duality of Drought: Pelagic- and Benthic-Spawning Stream Fishes Show Opposing Responses to Drought in the Southern Great Plains

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Keywords: drought, Shoal Chub, Peppered Chub, Prairie Chub, Brazos River, Canadian River, Red River

The highly flow-responsive genus of *Macrhybopsis* fishes in the Great Plains are excellent indicator species for freshwater availability but face immense threats of extirpation and extinction. As conditions in the Great Plains are projected to become drier due to disrupted precipitation patterns and increasing temperatures, understanding and predicting water availability in freshwater systems is imperative to maintaining stream health while still meeting water needs in the region. We assessed the role of drought intensity as a proxy for water availability on predicting fish occurrence at six stream gages by constructing species-specific random forest models for Shoal Chub *Macrhybopsis hyostoma* in the Brazos, Peppered Chub *M. tetranema* in the Canadian, and Prairie Chub *M. australis* in the Red River

basins. These models were then used to conduct ecological hind- and fore- casting to assess how the occurrence of these species have changed through time. We hypothesized that as drought intensity increased, the probability of occurrence would decrease across all species. We tested this hypothesis by regressing predicted probability of occurrence for each species (observed as well as hind- and forecasted) as a function of drought intensity and testing for significance. Results suggest species differ in magnitude of responsiveness to drought intensity, and this may suggest variable degrees of drought tolerance across the genus *Macrhybopsis* that could be reflected in species-site-specific conservation actions or could be used to generate priority sites and/or species for conservation. Our study better informs conservation of imperiled *Macrhybopsis* fishes by addressing gradients of occurrence across the temporal dimension of flows at localized and actionable scales, such as a particular stream gage or series of stream gages.

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Advancing Native Fish Conservation in Texas (2013-2025)

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Keywords: Native Fish Conservation Areas, Species of Greatest Conservation Need

Native fish conservation in Texas has advanced through implementation of the Native Fish Conservation Areas (NFCAs) concept outlined in Williams et al. (2011). In 2013, Texas Parks and Wildlife Department, in partnership with University of Texas at Austin and U.S. Fish and Wildlife Science Applications Program, identified a statewide network of 20 watersheds that met the NFCA criteria. Since then, we have hosted webinars, workshops, and websites to gather input on conservation actions and research needs; developed multi-year conservation plans for delivery of research, monitoring, and restoration actions in each NFCA; and assembled a statewide strategic plan for the NFCA network. Biological sampling was also designed and implemented to fill critical data gaps in the state's fish distribution dataset with a focus on NFCAs. TPWD recently published updates to our freshwater fish Species of Greatest Conservation Need as well as the lists of state threatened and endangered species. This poster will highlight results of those efforts and summarize future investments. Planned efforts include spatial and temporal expansion of gap sampling, updating species distribution models and NFCA prioritization, tracking progress of NFCA actions, and hosting workshops and webinars to update conservation needs assessments and plans for many of the NFCAs. A new statewide Strategic Plan will be used to update imperiled species lists in 2023 and the 2025 Texas State Wildlife Action Plan. These investments will inform project-based funding allocations to promote recovery of imperiled native freshwater fishes in Texas should the Recovering America's Wildlife Act materialize.

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Phylogenetic Relationships of Four Imperiled Great Plains Cyprinids

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Keyword: phylogenetics, Sharpnose Shiner, Smalleye Shiner, Rio Grande Shiner, Arkansas River Shiner

Notropis is an ecologically diverse genus within the family Cyprinidae. The genus has over 91 small-bodied fishes found from Mexico to Canada. There have been many efforts to place the species within the genus into a phylogenetic framework, however, the large number of species precludes the inclusion of all species. Recently, Schonhuth et al. (2018) created an extensive phylogenetic framework for North American cyprinids and included > 60 *Notropis* species, but did not include four *Notropis* species found in the Southern Great Plains, the Sharpnose Shiner (*Notropis oxyrhynchus*), Smalleye Shiner (*Notropis buccula*), Rio Grande Shiner (*Notropis jemezianus*), and Arkansas River Shiner (*Notropis girardi*). These four species are imperiled throughout their ranges, and understanding their phylogenetic relationships can give insight into their conservation. Therefore, these four species were placed into the existing phylogenetic framework created by Schonhuth et al. (2018) to determine their relationships with other members of the genus *Notropis*. We sequenced two mitochondrial genes (COI and Cytb) and two nuclear genes (Rag1 and IRBP) for the four species. Maximum likelihood and Bayesian analyses were used to generate four gene trees and were combined into a species tree using ASTRAL-II. The four gene trees and two species trees were generally congruent. The species trees showed that *N. girardi* was present in the *N. volucellus*-*N. spectrunculus* lineage and should be removed from the *N. bairdi* species group. The *N. bairdi* species group should include *N. bairdi*, *N. buccula*, and *N. braytoni*. *N. oxyrhynchus* was a sister species to *N. atherinoides*, and basal to these two was *N. jemezianus*. Overall, the support for the new groupings had strong support, but more sequence data and inclusion of more *Notropis* species can help to elucidate the relationships between these four species of Great Plains minnows.

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Natural History and Conservation Assessment of the Red River Shiner (*Notropis bairdi*, Hubbs and Ortenburger)

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Keywords: Red River Shiner, Red River

In this study, components of the Species Status Assessment were incorporated in the natural history assessment of the Red River Shiner *Notropis bairdi* to facilitate information sharing between researchers and resources managers responsible for species protection. Red River Shiner is not a currently listed species nor a candidate species for listing by USFWS, but its limited range and status as a Species of Greatest Conservation Need suggest that future federal involvement might be warranted. Study objectives were to document occurrence, abundance, habitat association, age structure, reproduction, diets, and assessing current conditions of the Red River Shiner within upper Red River basin. Red River Shiner was taken from 40% of sites sampled and are short-lived, early maturing species associated with shallow, moderate current velocities, and silt to sand substrates, where they feed

predominantly on a variety of aquatic and terrestrial invertebrates. Based on indicators of resiliency, representation, and redundancy, current condition was ranked 22 among 51 federally-listed and common species, using a previously published methodology for rapid estimation of current conditions among Texas fishes. Combining traditional natural history work with estimates of current condition enables the potential for clearer communication among ecologists, biologists, and resources managers.

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Seasonal Abundance and Diversity of Pipefishes and Seahorses from Estuarine Habitats in Matagorda Bay, Texas

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Keywords: pipefish, seahorses, Matagorda Bay

Vegetated habitats are important components of estuarine seascapes in the Gulf of Mexico and support a diverse range of marine fishes. Unlike some fishes that only spend a few months in the estuary to spawn, pipefishes and seahorses (family Syngnathidae) are common constituents of estuarine seascapes as both juveniles and adults. This year-long presence in the estuary can be quantified to detail expected density of estuarine fish populations. Despite being common constituents of estuarine fish assemblages, few studies have quantified the seasonal abundance and diversity of syngnathids along the Texas Gulf Coast. In the present study, benthic sled surveys were conducted to characterize the abundance and diversity of pipefishes and seahorses within seagrass and saltmarsh habitats in Matagorda Bay, Texas. A total of 274 individuals, representing 5 species (4 pipefishes, 1 seahorse), were collected during surveys taken between November 2019 and December 2020. Peak abundance of syngnathids occurred in Fall (mean = 0.16 fish/m²) with a secondary peak in abundance occurring in Summer (mean = 0.11 fish/m²). Similarly, diversity was significantly higher in Fall, specifically in October, than in any other season (October H' = 1.7). Our findings indicate that syngnathids are common in both seagrass and saltmarsh habitats and add to the assemblage diversity of Matagorda Bay, potentially enhancing the productivity and resilience of this estuarine ecosystem.

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Survival and Growth in Multiple Size Classes of Hatchery-Released Red Drum (*Sciaenops ocellatus*) over Three Seasons in Matagorda Bay, Texas

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Keywords: Red Drum, Fulton's K, fingerling survival

Assessing the survival of hatchery-released fingerlings is an important step in determining overall success of marine stock enhancement programs. The Texas Parks and Wildlife Division's (TPWD) Marine Stock Enhancement Program introduces 20 to 30 million red drum (*Sciaenops ocellatus*) fingerlings into bays across Texas each year, however determining growth rate and survival of these fingerlings immediately after release has been limited to small tagging studies. Furthermore, the program releases red drum fingerlings during periods in which wild juvenile red drum are not recruiting to the estuaries, indicating that hatchery-released fish are introduced to conditions which they would not

normally encounter as early-stage juveniles in the wild. Moreover, fingerlings are released at a wide range of sizes outside of the target release size of 35 mm, and body size and body condition are both good indicators of survival in the wild. This study aims to determine the impacts of variation in environmental parameters and initial size upon release on overall growth rate, body condition, and survival of Red Drum fingerlings within one month of harvest and release. Preliminary data collected within the first two years of this project indicates that fish with an initial size above 35 mm have higher overall survival and growth rate over all three “seasons” of release, however final body condition (Fulton’s K) was not significant across size class. Fitted multiple linear regression modeling also determined that water temperature, salinity, and size class were significant indicators of estimated growth rate. In addition, daily growth of hatchery fingerlings exceeded estimated growth rates of wild juveniles collected by TPWD. This indicates that releasing larger sized individuals may improve growth and survival of these fish, especially during peak months of fingerling release when temperature conditions regularly rise above thermal optimum for juveniles of this species.

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Rio Grande Valley Reef Artificial Structures: Its Longevity and Characterization

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Keywords: artificial reefs, Rio Grande Valley Reef, concrete pyramids

Artificial reefs constructed to serve as habitat were first documented in Japan several centuries ago and are now used to counter habitat loss across the globe. Off the shore of Texas, natural reefs feature hard structure that are necessary for reef fish communities to form. However, these are naturally sparse on the soft sediment dominated seafloor and have been further destroyed through anthropogenic activity such as shrimp trawling. The Rio Grande Valley (RGV) Reef was permitted through the efforts of Texas Parks and Wildlife Department (TPWD) in 2015. In the present research, large concrete pyramid structures are compared over several years to determine longevity based on their measured heights and positions over time. Data was collected via swath bathymetry and side scan sonar using an Edgetech 6205-S. 3D plots and sidescan mosaics will be assembled using Hypack and SonarWiz programs to characterize the pyramid reef compared to previous recordings made in 2018. Pyramids will be examined for loss of height, movement, and the depth of the scours at their base. Compared to the results of the previous survey, an overall estimate of longevity of these pyramid placements can be calculated.

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Utilizing Biological Monitoring to Guide Implementation of an Aquatic Plant Restoration Project for the Fountain Darter (*Etheostoma fonticola*)

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Keywords: Fountain Darter, *Hygrophila polysperma*, *Cabomba caroliniana*, Comal River, habitat restoration

Many habitat restoration projects are conducted with limited data to guide implementation, as historical or baseline data are rarely available to characterize the structure and function of the site before

impairment. Additionally, few habitat restoration projects are provided the opportunity to conduct simultaneous monitoring of habitat conditions and target organism responses, which are crucial to evaluate long-term success. In 2013, as part of the Edwards Aquifer Habitat Conservation Plan (EAHCP), a large-scale aquatic plant restoration project began in select reaches of the Comal Springs/River ecosystem to preserve and improve habitat conditions for the federally-endangered Fountain Darter (*Etheostoma fonticola*). This ongoing project involves mechanical removal of an invasive aquatic plant (*Hygrophila polysperma*) and re-introduction of native aquatic plants which are more suitable habitat for Fountain Darters. In this study, we used 22 years of biological monitoring data in the Old Channel Reach of the Comal River to display long-term changes in the aquatic plant community and examine the influences of exotic plant invasion and subsequent restoration on the Fountain Darter population in this reach. From 2000-2012, annual coverage of *H. polysperma* increased from 0-1,820 m², and has subsequently decreased to 0 m² following restoration efforts. Additionally, coverages of taxa that are more suitable Fountain Darter habitat (bryophyte and *Cabomba caroliniana*) have increased since restoration began. Annual trends in Fountain Darter density and recruitment were negatively associated with *H. polysperma* coverage. Native aquatic plant restoration has resulted in an increase in Fountain Darter densities and recruitment, supporting that increased availability of more suitable habitat has had a positive effect on the Fountain Darter population in this reach. Results demonstrate the benefit of long-term monitoring programs to evaluate the effectiveness of habitat restoration and provide quantitative data relating spatiotemporal changes in habitat conditions to Fountain Darter populations.

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Piercing and patching the armor: Assessment of Abdominal Incision Closure and Healing During Transmitter Insertion on Invasive Suckermouth Armored Catfish

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Keywords: tagging, suckermouth armored catfish, anesthetic, invasives

Suckermouth armored catfishes (SAC) belonging to the family Loricariidae, particularly the *Hypostomus* and *Pterygoplichthys* genera, have invaded freshwater ecosystems globally. As interest in managing SAC invasions emerges, so does a need to understand movement ecology and habitat associations. However, virtually no research on SAC movement ecology exists and there is little guidance on best practices for internally inserting tracking devices, including anesthetic identity and concentration, tag dimensions, or methods for closing incisions. We assessed the efficacy of clove oil (30 mg/L) as an anesthetic and wound closure methods for internal subminiature transmitters (PT-3: 19 x 7.8 mm, PT-4: 25 x 9 mm; Sonotronics, Tucson, AZ) in SAC. Dummy tags were surgically implanted into the peritoneal cavity of anesthetized SAC (157-394 mm TL) using a 2-cm incision. We tested three wound closure techniques, including a single simple interrupted suture with cyanoacrylate adhesive applied along the length of the incision (n = 10), a simple interrupted pattern with two sutures and no adhesive (n = 8), and an x-shaped pattern with a two sutures tied with a single knot and no adhesive (n = 8). We also quantified time to stage-4 anesthetization (i.e., loss of equilibrium) and recovery from clove oil. There was no relationship between fish total length (mm) and time (seconds) to

anesthetization ($F_{1,24} = 0.21$; $P = 0.65$, $R^2 < 0.01$), but recovery time was longer for larger fish ($F_{1,24} = 5.18$, $P = 0.03$, $R^2 = 0.18$). Cyanoacrylate caused notable tissue inflammation and necrosis, and ultimately resulted in tag loss ($n = 4$) or mortality ($n = 1$) among fish in that treatment. We conclude that clove oil is a suitable anesthetic, PT-3 or PT-4 tags fit within the peritoneal cavity, and suture closure without the use of cyanoacrylate adhesive are appropriate for inserting transmitters in adult SAC.

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Fisheries Creel Surveys as a Tool for Assessing Waterfowl Harvest Trends on the Texas Coast: A Potential Collaboration Between Fish and Wildlife Professionals

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Keywords: waterfowl, creel surveys, hunting

Texas Parks and Wildlife Department (TPWD) has been collecting fisheries-dependent data across the Texas coast as part of the Texas Marine Sport-Harvest Monitoring Program since 1974. This survey is the longest continually running saltwater creel survey in the United States. As a part of this survey, TPWD collects data on all activities intercepted during its creel surveys, including hunting activities. Although not designed to capture waterfowl harvest, this data could represent a long term and standardized supplement to other waterfowl surveys across the state, though, until now, it has not been utilized to monitor such trends. Results from these surveys indicate that both total waterfowl harvest and hunter effort have experienced significant increasing trends along the Texas Coast. Harvest rates varied by species with Redhead (*Aythya americana*) exhibiting a significant increasing trend and Northern Pintail (*Anas acuta*) exhibiting a declining trend during the study period. While the annual total number of species harvested by hunters increased across the study period, the diversity of hunter bags decreased, likely due to decreasing evenness of species harvested by hunters. Not only does this study provide a long-term status and trends report of waterfowl harvest by species and bag diversity over time, but it also provides a great example of the interdisciplinary uses of fisheries survey data and the potential for beneficial collaboration between fish and wildlife professionals.

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Dwarf Seahorse (*Hippocampus zosterae*) Distribution, Abundance, and Sampling Gear Catch Efficacy in Texas

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Keywords: Dwarf Seahorse, throw trap, pushnet, Gulf of Mexico

The Dwarf Seahorse (*Hippocampus zosterae*) is one of the smallest species of seahorse (2.5 cm at maximum height) and resides in shallow waters throughout the Gulf of Mexico, Atlantic Coast of Florida, and Caribbean. This species is currently a candidate for listing under the Endangered Species Act. With limited mobility, individuals often take refuge in seagrass beds, using their prehensile tails to attach to the vegetation. Historically, little was known about this species in Texas, other than occasional incidental observations. We sampled 80 sites from Galveston Bay to the Lower Laguna Madre in the

summer of 2020 using a 1m pushnet. Eight sites were then selected based on high catch per unit effort (CPUE) of Dwarf Seahorse and physical conditions for a gear comparison study in 2021. Included in the gear comparison were pushnet, throw trap, beam trawl, 60' bag seine, and 15' straight seine. A total of 91 Dwarf Seahorse were collected throughout the study from all bay systems except for Galveston Bay. The species composition of the catch among all gear types was significantly distinct (except between beam trawl and straight seine). Dwarf Seahorse CPUE was significantly highest for the throw trap and the pushnet yielded the second highest CPUE. No Dwarf Seahorses were caught using the 15' straight or 60' bag seines. Due to their small size and propensity for shallow seagrass beds, typical coastal gear types such as seines or otter trawls, which are widely used by state resource management agencies, severely underestimate the abundance of Dwarf Seahorses. This study provides initial distribution and abundance information for Dwarf Seahorse in Texas. The use of targeted gear types such as throw traps and pushnets are necessary to accurately monitor Dwarf Seahorse populations and inform a federal listing.

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Testing for Sexual Dimorphism in an Invasive Population of Suckermouth Armored Catfish

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Keywords: suckermouth armored catfish, invasive, San Marcos River, infrared light

Estimating the abundance of non-native, invasive species is a critical part of managing invasions, particularly when population control programs exist. However, accurately estimating abundance of invasive species that are cryptic, nocturnal, mobile, or otherwise difficult to catch can be challenging. Invasive suckermouth armored catfish (SAC) belonging primarily to the genera *Hypostomus* and *Pterygoplichthys* are present throughout the upper San Marcos River and are the focus of control efforts. To address the challenges of estimating SAC abundance, we developed a novel recorded, visual-based method to monitor and estimate abundances using a lighted infrared fish enumeration raft (LIFE raft). Our raft is constructed from consumer-grade materials including a polyvinyl chloride frame, 12-volt marine battery, infrared (~840 nm) auxiliary lights, and four full spectrum high-definition compact cameras. We elected to use infrared lighting rather than standard visible light (~500 nm) because SAC are photophobic and generally move to avoid direct light. Thus, employing light in the infrared spectrum allowed us to visually observe nocturnal SAC without disturbing the fish and potentially disrupting abundance estimations. This type of visual method for observation can be the basis for data collection and analyses such as N-mixture models that incorporate covariates for both abundance and detection (i.e., observation of species when they are present) parameters. In the case of the San Marcos River, useful covariates for detection included water depth and vegetative cover. We plan to use the LIFE raft to monitor temporal fluctuations in abundance across seasons and prior to and following spearfishing control applications. Systems like the LIFE raft can be used in other clear water ecosystems to estimate the abundance of visually detectable invasive species that are mobile, difficult to capture, and active at night.

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

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Keywords: Sabine Lake, Sabine Lake System Acoustic Array, Texas Acoustic Array Network, SLSAA, TEXAAN, iTAG

An array of 20 acoustic receivers (VR2Tx) has recently been deployed throughout the Sabine Lake System to monitor fish movements and residency within multiple estuarine and nearshore habitat types as well as movement among estuaries along the Gulf of Mexico. The Sabine Lake System Acoustic Array (SLSAA) is part of a network of bay-scale and nearshore acoustic receiver arrays that now exist across the Texas Coast as well as much of the US Gulf of Mexico coast referred to as the Texas Acoustic Array Network (TEXAAN) and the Integrated Tracking of Aquatic Animals in the Gulf of Mexico (iTAG) respectively. The VR2Tx acoustic receivers used throughout the array are able to detect tagged fish within a ~0.5 km radius of the receiver location. Therefore, the Sabine Lake System is well-suited to allow high resolution monitoring of fish movement due to many single access bottlenecks into major portions of the surrounding marsh, rivers, and Gulf of Mexico. Initial year one acoustic tagging in the Sabine Lake System is focusing on Southern Flounder and Spotted Seatrout, both of which have undergone regulatory changes recently and are the subject of much debate surrounding population dynamics and the effects of environmental forcings that influence their behavior. Several species of interest are being tagged in other estuarine systems, including Black Drum, juvenile Bull Shark, juvenile Blacktip Shark, Alligator Gar, Tarpon, and Asian carp. We anticipate the SLSAA will improve life history understanding of Northern Gulf of Mexico fish species, provide data that presently does not exist for Southeast Texas, and facilitate collaboration between academic institutions and state/federal management agencies. In addition, several other Gulf state agencies are also conducting simultaneous Southern Flounder tagging studies, which should provide data for flounder migratory comparisons across states.

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Sample Preparation Methods for Stable Isotope Analysis: Implications for Trophic Ecology Studies

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Keywords: stable isotopes, Common Dolphinfish, Yellowfin Tuna, Swordfish

Trophic ecology studies are an important area of research for global fisheries. Trophic tools, such as stable isotope analysis, can elucidate the relationship between the chemical composition of tissue and the diet patterns of an individual. However, with emerging analytical approaches and multiple sample preparation methods, it is important to ensure compatibility between approaches. This project analyzes the differences in three drying methods typically utilized in sample preparation for bulk and compound specific stable isotope analysis. Muscle tissue biopsies were taken from Common Dolphinfish (*Coryphaena hippurus*), Yellowfin Tuna (*Thunnus albacares*), and Swordfish (*Xiphias gladius*) collected from the Gulf of Mexico. Muscle tissue biopsies of Yellowfin Tuna and Swordfish were

divided into two treatments: 1) dried by freeze dryer only, 2) dried with dehydrator prior to freeze dryer. Muscle tissue biopsies of Common Dolphinfish were divided into three treatments: 1) dried by freeze dryer only, 2) dried with dehydrator prior to freeze dryer, 3) dried by dehydrator only. After drying treatments, all biopsies were powdered and packaged for stable isotope analysis at University of California, Davis's Stable Isotope Facility. Both bulk stable isotope analysis and compound specific stable isotope analysis were conducted. Non-significant differences between and among treatments indicated that drying methods did not alter isotopic ratios and that samples prepared differently were comparable. Our findings indicate that more cost-effective and portable drying methods, such as a dehydrator, are appropriate for muscle tissue preservation when a freeze dryer is not available. These findings will be described in terms of the implications for trophic ecology studies in large bony fishes.

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