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## 2019 Southeastern Fishes Council State Reports

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## 2019 Southeastern Fishes Council State Reports

### Keywords

State Reports

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**Alabama:** Jeff Ray (jrray1@una.edu)

Alabama Department of Environmental Management – Submitted by Cal C. Johnson

- ADEM, GSA, UNA, TVA, APCO selected priority SHU (Strategic Habitat Units) to conduct shoreline nonwadeable IBI assessments to further develop IBI criteria and metrics for nonwadeable rivers in AL.
- Assisted USFWS, GSA, and the Atlantic Coastal Conservancy sample sites on ACC property for the federally threatened *Etheostoma trisella*.
- ADEM conducts annual surface water IBI stream assessments to provide support for the departments surface water quality division.
- Support the Alabama Rivers and Streams Network group in assisting with data collection which will support the watershed recovery and restoration effort in Strategic Habitat Units.

Alabama Power Company – Submitted by Chad Fitch and Dylan Shaw

- Alabama Power Company (APC) partnered with U.S. Fish and Wildlife Service (USFWS) to remove two perched culverts and install a bridge to enhance water flow and fish passage at a trispot darter (*Etheostoma trisella*) breeding site on APC property; funding for the project was provided through the Partners for Fish and Wildlife Program Grant and matching contributions from APC.
- Two post construction monitoring visits were conducted in November and December of 2019 (before peak breeding season) to assess the project's impact; 10 individuals were observed (9 females downstream of bridge and 1 male upstream) in November of 2019; nine individuals (7 females and 1 male downstream; 1 female upstream of bridge) were observed during the December 2019 sampling event.
- As part of an ongoing In-Kind Services agreement with the United States Forest Service (Bankhead National Forest Ranger District), Alabama Power Company biologists Steve Krotzer, Jeff Baker, and Dylan Shaw assisted biologists John Moran and Allison Cochran (U.S. Forest Service) with surveys for the federally endangered Rush darter (*Etheostoma phytophilum*). 20 individuals were located in tributaries to Clear Creek, marking the first time the species has been documented inside the Bankhead National Forest.

Auburn University Museum of Natural History – Submitted by Jonathan Armbruster

- Jonathan Armbruster is working with Pamela Hart, Prosanta Chakrabarty, Matthew Niemiller, and others on a phylogenomic analysis of Amblyopsidae.
- Courtney Weyand and Jonathan Armbruster are working on the population genetics of the daces of *Rhinichthys*.
- Davide Werneke, Katie Lawson, and Jonathan Armbruster are completing a survey of the fishes of Redstone Arsenal, Huntsville, AL.
- Jonathan Armbruster is working with Brian Helms, David Laurencio, and Alfred Schotz on an assessment of reference wetlands for Alabama.

- Carla Stout, Jonathan Armbruster, Richard Mayden, and Sarah Schönhuth are completing a phylogenomic analysis of the shiners.
- David Werneke is working on incorporating Elise Irwin's collections into the Auburn University Museum of Natural History's fish collection.

#### Geological Survey of Alabama – Submitted by Stuart McGregor

- Alabama Rivers and Streams Network (ARSN) partners, including GSA, USFWS, and ADCNR, have designated 60 stream systems or stream reaches within and near Alabama as Strategic Habitat Units (SHUs) or Strategic River Reach Units (SRRUs) based on the presence of rare aquatic species as a tool to focus restoration and recovery efforts. Those locations are presented on GSA Special Map 248B and the information supporting that map is available on the ARSN website, [www.alh2o.org](http://www.alh2o.org). GSA staff continues assisting USFWS staff update SHU-related accomplishments from 2008-present.
- ARSN along with TVA and Auburn University researchers completed fish IBI surveys and other assessments in the Bear Creek (Tennessee River) SHU in 2013 and GSA is currently producing a special map to reflect those findings.
- ARSN completed fish IBI surveys and habitat evaluations in the Sipsey River (Tombigbee River) SHU in 2013 and published the results as a GSA circular in 2019.
- ARSN team members completed fish surveys in the Murder Creek SHU (Conecuh River) in 2012 and published that information as a GSA circular in 2019.
- Changes in the distribution of fishes in the Locust Fork SHU from 1997 to 2011 was published as a GSA Bulletin in 2019.
- An assessment of the Terrapin Creek SHU (Coosa River) for recovery and restoration of rare mussel species was completed by ARSN and information from other researchers was included and published as a GSA bulletin in 2019.
- GSA along with the CAWACO RC&D completed road-stream crossing surveys in the lower third of the Locust Fork SHU to identify fish passage barriers and sources of sediment to streams in the watershed and have begun assessing those in the upper third of the watershed.
- GSA continues monitoring Alabama Cave Shrimp and Tuscumbia Darter populations and related water quality monitoring on Redstone Arsenal.
- GSA continues monitoring the Watercress Darter population on Watercress Darter NWR.
- GSA continues efforts to survey Trispot Darters for ongoing distribution study along with University of West Alabama and Georgia DNR staff.

#### The University of West Alabama – Submitted by Mike Sandel

- Southern Walleye population genomics and eDNA - Alex Rakestraw, MSc candidate.
- Trispot Darter population genomics and eDNA - Kayla Fast, MSc and research associate.
- Bullhead Minnow introgression in the Tenn-Tom waterway - Kiersten Schellhammer, MSc candidate.
- Green Swordtail invasion of Florida, genomics and stable isotopes - Anna Eastis, MSc candidate.

- Coal Darter population genomics and eDNA - Kenny Jones, MSc candidate.
- Metabarcoding Mobile Basin fishes - John Larrimore, MSc candidate.
- Genomics of the Graves Creek Stream capture (Tennessee to Black Warrior faunal transfer) - Julia Wood, MSc student.

USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Stream Ecology Lab – Submitted by Zanethia Barnett

#### Crayfishes

- Investigation of the effects of impoundments on stream crayfishes' assemblages, distributions, and gene flow (Barnett & Adams).
- Comparison of 3 crayfish and fish sampling methods in Southern Appalachian mountainous streams (Barnett & Adams).
- Investigation of the use of fishes to sample crayfishes in large water bodies (Adams, Barnett with numerous collaborators).
- Outreach

Barnett, Z.C., S.B. Adams, C.A. Ochs, and R.C. Garrick. In press. Crayfish populations genetically fragmented in streams impounded for 36-104 years. *Freshwater Biology*.

Barnett, Z.C. 2019. Effects of impoundments on the community assemblage and gene flow of stream crayfishes. Dissertation. University of Mississippi, University, Mississippi, USA.

Barnett, Z. C., S. B. Adams, C. A. Ochs, R. C. Garrick. 2019. Crayfish populations genetically fragmented in streams impounded for 30-104 years. Evolution Conference. 23 June. Oral Presentation. Volunteer.

University of North Alabama – Submitted by Jeff Ray

- Publishing the fishes of Cypress Creek (Tennessee River drainage) within the biodiverse Pickwick Lake sub basin as a Geological Survey of Alabama bulletin. Current fauna totals 99 species in a 215 mi<sup>2</sup> watershed.
- Continuing to sample the fishes of Butler Creek (Shoal Creek system) in southern Tennessee and northern Alabama 2019-20.

**Louisiana:** Marty O'Connel (moconnel@uno.edu)

From Robby Maxwell (LDWF)

- In the Pearl River basin, District 8 has concluded a Frecklebelly Madtom (*Noturus munitus*) survey where they observed 724 individuals of the species across 19 sample sites using riffle kicks combined with backpack electrofishing. District 8 also concluded a mussel survey of the Bogue Chitto National Wildlife Refuge and adjacent waters, collecting assemblage data at 50 locations.
- In the Calcasieu basin, District 5 continued Scenic Stream sampling in 6-Mile Creek, 10-Mile Creek, and the Whiskey Chitto. Fish were sampled using backpack electrofishing and seines, and mussels were sampled using 90-minute tactile surveys. A new locality of *Pleurobema reddelli*, a species petitioned for listing, was collected during these surveys.

- Age, Growth, and Mortality studies on Largemouth Bass and Crappie populations continue in various waterbodies statewide. These projects have been invaluable assessments aiding in management decisions and influencing public perceptions of different populations.
- American Eel (*Anguilla rostrata*) research continues with 352 eels processed, to date. Length, weight, age, stomach contents, and the presence of the invasive swim bladder parasite, *Anguillicoloides crassus*, have been recorded for each specimen. All eels were collected throughout the state incidentally as bycatch, and delivered to Lake Charles for processing.
- In partnership with USACE and USWFS, LDWF assisted in the fish rescue conducted after the closing of the Bonnet Carre Spillway. Seventeen Pallid Sturgeon, 208 Shovelnose Sturgeon, and a number of Paddlefish and American Eels were caught below the Bonnet Carre. One Pallid and 43 Shovelnose were dead, and 16 Pallid and 165 Shovelnose Sturgeon were relocated to the Mississippi River. Black Carp were caught for the first time that low in the Mississippi Basin.
- LDWF continues to monitor and/or control aquatic invasive species throughout the state. Notably, Asian Swamp Eels (*Monopterus albus*) were discovered in Bayou St. John, New Orleans. LDWF will continue to monitor their spread in 2020. Invasive aquatic vegetation is still a major issue, and LDWF crews and contractors continue control efforts. Approximately 39,300 acres of nuisance aquatic vegetation were treated in 2019.
- At the Richard K. Yancey WMA, LDWF will be improving fish habitat in the Blackhawk Scar Lakes. Fish-passage culverts will be installed to allow better movement of fishes to the lakes, and a weir will be installed to improve water quality by holding more water in the system during dry periods. After completion, we will conduct fisheries monitoring, and are planning a project focusing on gars. We are currently waiting for water levels of the Mississippi River to recede to begin construction.
- The Louisiana Watershed Initiative is going to be placing 80-120 new stream gauges throughout the state. The primary objective is to contribute to modeling efforts, but they will be beneficial to other stream monitoring applications and fisheries research.

**Mississippi:** Jan Hoover (hooverj@wes.army.mil) & Todd Slack (Todd.Slack@usace.army.mil)

US Army Engineer Research and Development Center (ERDC), Waterways Experiment Station, Environmental Laboratory, Aquatic Ecology and Invasive Species Branch, Vicksburg MS. The ERDC Fish and Invertebrate Ecology Team, now in its 33<sup>rd</sup> year, consists of Jack Killgore, Jay Collins, Nicky Faucheux, Nick Friedenberg (Applied Biomathematics, Setauket NY), Steven George, Rebecca Hahn, Audrey Harrison, Jan Hoover, Alan Katzenmeyer, Lauren Leonard, Bradley Lewis, Catherine Murphy, Amanda Oliver, and Todd Slack. Projects are concentrated in the Lower Mississippi Basin and nearby southern waters.

- Missouri River Studies, sponsored by USACE Northwestern Division, enabled sampling of the Lower Missouri River to investigate diets, foraging habitat, and food availability for young of year Pallid Sturgeon and Shovelnose Sturgeon in the lower river.
- Mississippi River Studies are sponsored by the USACE Mississippi Valley Division, Mississippi River Geomorphology and Potamology Program, St. Louis District, and Vicksburg District. Sturgeon telemetry studies continued riverwide using a combination of fixed position and mobile receivers on USACE vessels. In the Middle Mississippi

River, the team conducted studies of invertebrate drift, based on field collections, and a comprehensive survey of secondary channels of the free-flowing river from Alton IL to Cairo IL, based on archived imagery, charts, and bathymetric data. The team also studied secondary channels in the Lower River, sampling fishes, mussels and benthic invertebrates as part their long-term monitoring efforts to evaluate the importance of channel restoration efforts following dike notching, sponsored in part by the Lower Mississippi River Conservation Committee, and representing the 20<sup>th</sup> consecutive year of sturgeon sampling in the river.

- In the Lower Mississippi River, the team evaluated invertebrate colonization on substrates, natural (clay, wood) and artificial (rip-rap, articulated concrete mattress), by sampling substrates deployed in wire baskets attached to buoys to quantify productivity of each habitat and its relative importance to fisheries. The team also completed multi-year larval fish sampling in a backwater of the Lower Mississippi River near Clarksdale, MS. Using light traps and ichthyoplankton nets, the team described spawning chronology of resident fishes and comparative productivity of different water bodies with varying levels of riverine connectivity.
- Also, in the lower river, the team sampled borrow pits, from Helena AR to Donaldsonville LA, as part of an aquatic assessment of raising levees at certain areas between Cape Girardeau, MO to the mouth of the Mississippi River. Data were collected by seines, gillnets, and an autonomous underwater vehicle (AUV) and demonstrated that borrow pits support numerous and diverse fishes (even those impacted by dense cow populations). Study results will be used to recommend environmental design features of borrow pits to optimize species richness and diversity of floodplain and riverine fishes. Lastly, Shovelnose Sturgeon and Pallid Sturgeon entrained through the Bonnet Carré Spillway in 2019 were rescued, enumerated, and returned to the river. This was the fifth time, since 2008, that ERDC rescue operations have been completed after the opening and closing of the structure to divert flood waters from New Orleans. Results are being used to develop models of entrainment rates and population impacts. Other species rescued in the spillway included Gulf Sturgeon and Paddlefish.
- Yazoo Basin studies are funded by the USACE Vicksburg District. One study consisted of hoopnetting streams as a follow-up to a prior survey in the 1990's that evaluated demersal fish abundance and diversity after channelization and potential benefits of structural restoration measures. Data from the current study will also be used to evaluate subsequent impacts of Asian Carp, which were observed and sampled this year spawning en mass. Another study consisted of sampling the Yazoo backwater project area, the subject of a contentious debate between supporters and opponents of the Yazoo Pump Project.
- Pearl and Pascagoula River studies include collaborations on Gulf Sturgeon research with Mark Peterson, Mike Andres and Paul Grammer at the University of Southern Mississippi. Field studies are conducted under auspices of the Ship Island restoration project, part of the USACE Mississippi Coastal Improvements Program.
- Savannah River tributary studies are funded by the US Army Fort Gordon GA. Streams in the Spirit Creek and Brier Creek drainages, sampled in the mid-1990s, were resampled a quarter century later using the same gear and protocol (and two of the same personnel). Results will be used to assess long-term changes in the aquatic fauna of the installation and to explore possible impacts of stream erosion.

- Paddlefish studies for the development of bio-inspired materials and structures continue in collaboration with the ERDC Information Technology Laboratory. This past year, instrumentation was developed and tested for measuring hydrodynamic strain and stability of the Paddlefish rostrum in moving water. Tests were performed with amputated rostra in a swim tunnel preliminary to tests planned on live fish.

Matt Wagner, Mississippi Museum of Natural Science, Jackson, MS, reports the following notable activities for 2019.

- MDWFP (Mississippi Department of Wildlife, Fisheries and Parks) surveyed 51 historic Frecklebelly Madtom (*Noturus munitus*) localities throughout the Tombigbee River Drainage in Mississippi. Frecklebelly Madtom were found at 17/19 Sites on the East Fork Tombigbee River, 13/15 Sites on the Buttahatchee River, and 11/12 Sites on Luxapallila Creek. The collections in these three tributaries had high CPUE and little reduction in river kilometers occupied. No individuals were collected in the five sites surveyed in Bull Mountain Creek and no collections were able to be made on the historic Tombigbee River due to the Tennessee-Tombigbee waterway. Frecklebelly Madtom were estimated to occupy 42% of the historically occupied river kilometers in the Tombigbee River Drainage in Mississippi.
- MDWFP surveyed 53 sites using a small mesh benthic trawl over the 80 river-kilometer stretch between the confluence of the Leaf River and Chickasawhay River and Poticaw Landing, Mississippi for Pearl Darter (*Percina aurora*). A total of 16 Pearl Darter were collected among 9 of the 53 sampled localities and a 1.45 km increase in the southern known range of the species was found.

Larry Bull, MDWFP Assistant Chief of Fisheries, provided the following research topics the agency pursued in 2019:

- Part of a collaborative multi-agency effort along with USFWS, Tennessee Tech University, and the Alabama Department of Natural Resources to tag Asian carp with acoustic telemetry tags and track their movement in the Tennessee River and Tennessee-Tombigbee Waterway.
- Compared abundance and fish species composition between artificial and natural habitat complexes installed on MDWFP operated reservoirs.
- Evaluated efficacy of a mid-water trawl to adequately predict year class strength of White Crappie in a central MS reservoir by comparing age structure from otoliths collected from trawl sampling and angler harvest methods.

Mark Peterson, University of Southern Mississippi – Gulf Coast Research Laboratory was selected as one of the "ESCO Associate Editors of Distinction" for the journal *Estuaries and Coasts* for 2017-2019. In addition, Mark, Mike Andres and Paul Grammer continue to coordinate with Todd Slack (ERDC) on their multi-year Gulf Sturgeon monitoring efforts for the USACE Mobile District as part of their Ship Island restoration project.

Jake Schaefer, University of Southern Mississippi-Hattiesburg, highlighted the following efforts for 2019.

- Resurveyed 38 sites in the Bayou Pierre system that had been sampled in the 1980's-1990's. The goal of these samples was to assess current distribution and abundance of Bayou Darters.

- Sara Barrett completed her MS thesis which in 2019 involved 50 samples in the Pascagoula basin (primarily Leaf, Chickasawhay and Pascagoula Rivers) aimed at trying to understand the ecology of the Pearl Darters. We continue to collaborate with Dr. Brian Kreiser on the ecology and population genetics of Pearl Darters. Sara's thesis covered some dramatic shifts in fish assemblages of the Pascagoula.
- We surveyed 50 sites distributed throughout all MS National Forests. This completed year three of five resurveying fish assemblages at a set of sites initially surveyed by Dr. Mel Warren and collaborators in 1999-2000.

Ken Sterling with the U.S. Forest Service Southern Research Station located in Oxford, MS reports the following:

- Susie Adams and Zanethia Barnett continue their work on southeastern crayfish.
- Mel Warren continues his efforts to complete the compilation of volume 3 of the Freshwater Fishes of North American treatise.
- Headwater Stream Habitat Restoration on the Holly Springs National Forest: A Test of Methods and Effects. The premise is to use an experimental approach to test a habitat restoration method designed to increase wood in headwater streams. Data collection has begun. Researchers include: Ken Sterling, Robert Bergstrom, Melvin L. Warren, Jr., Ying Ouyang.
- Effects of Climate Change on Fitness in Imperiled Snubnose Darters. This effort uses indoor and outdoor mesocosms to test the effects of water temperatures and stream turbidity on reproductive output in four species of snubnose darter. This is year two of a project that could go on for a long time. Researchers include: Ken Sterling, Melvin L. Warren, Jr., Susan B. Adams.
- A short paper on the spawning substrate preferences of the Yazoo Darter is to be published in April. A phylogenetic study of Yazoo Darters is in review, and a monograph on comparative life histories of snubnose darters may go out for review this year.
- The search for the Wolf Darter continues. We are working with Matt Wagner (MMNS) to sample streams in the Wolf River drainage in an attempt to confirm the presence of snubnose darters in that drainage. We have one fish from a sample taken 30 years ago.

**Missouri:** Jacob Westhoff [Jacob.Westhoff@mdc.mo.gov](mailto:Jacob.Westhoff@mdc.mo.gov)

- Niangua Darter: The MDC continued their occupancy modeling approach to monitoring Niangua Darter populations. Overall, 2019 yielded among the highest number of Niangua Darter detections across both the Maries and Pomme de Terre Rivers since monitoring began in 2011 and occupancy rates have remained steady.
- Longnose Darter: The MDC funded a life-history and habitat study for the Longnose Darter through TN Tech University. MDC also finalized an eDNA survey that detected Longnose Darter in a tributary to the mainstem St. Francis River for the first time and extended the known range from 72 to 101 km. A second year of targeted searches in the White River drainage further confirmed the suspected extirpation of Longnose Darter from that part of its distribution.
- Ozark Cavefish: The MDC conducted eDNA surveys within the range of Ozark Cavefish and documented positive detections for the species from springs and wells that had not previously been logistically feasible to sample.

- Pallid Shiner: Bob Hrabik and students from Missouri S&T Ichthyology (Dr. Dave Duvernell) collected Pallid Shiners in MO for the first time since 1956. The collection occurred at Big Cane Conservation Area in extreme southern Missouri.

**North Carolina:** Bryn Tracy fieryblackshiner@gmail.com

Fritz C. Rohde is striving to finish the descriptions of the four species of Broadtail Madtoms with much assistance from Joe Quattro, Chip Collier, and Dustin Smith. Fritz has still been trying to find live material but has not been successful in many years and Hurricane Florence may have eliminated the few populations hanging on in the Cape Fear, Waccamaw, and Lumber river drainages.

From Luke Etchison and Dylan Owensby, North Carolina Wildlife Resources Commission – Aquatic Wildlife Diversity Section, Mountain Region:

- 28 fish surveys were completed in tributaries of the Little Tennessee River Basin searching for Smoky Dace, *Clinostomus* sp. nov., and other North Carolina Species of Greatest Conservation Need.
- 5 snorkel surveys searching for State Endangered Sharpnose Darters, *Percina oxyrhynchus*, were completed in the South Fork New River in the New River basin. Three Sharpnose Darters were found at one site. This was the first Sharpnose Darter sighting in the state since 2012.
- 16 surveys for Federally Threatened Spotfin Chub, *Erimonax monachus*, were completed in the restoration section of the Cheoah River (Little Tennessee River basin).
  - Spotfin Chub were abundant with multiple year classes present.
  - 1,830 Spotfin Chub were stocked by Conservation Fisheries Inc. into the restoration section of the Cheoah River.
- Fish were translocated from Cowee Creek, Scott Creek, and Savannah Creek (Little Tennessee Basin) to the restoration section of the Cheoah River in an effort to increase biodiversity. Species translocated included Gilt Darter (*Percina evides*), Greenfin darter (*Etheostoma chlorbranchium*), Banded darter (*Etheostoma zonale*), Tennessee shiner (*Notropis leuciodus*), Mirror shiner (*Notropis spectrunculus*), Telescope shiner (*Notropis telescopus*), Fatlips Minnow (*Phenacobius crassilabrum*), and River chub (*Nocomis micropogon*).
- A total of 6,198 juvenile Lake Sturgeon, *Acipenser fulvescens*, were stocked into the French Broad River downstream of the town of Marshall. Lake Sturgeon have been stocked annually in the French Broad River in North Carolina since 2015. Population surveys will begin in Fall 2019.
- Sicklefins Redhorse, *Moxostoma* sp. nov., augmentation and research efforts have continued in the Little Tennessee and Hiwassee river basins. Approximately 6,000 juvenile Sicklefins Redhorse were stocked into the upper Oconaluftee River sub-basin from broodstock collected in the Tuckasee River in Spring 2018.

From Thomas Russ, North Carolina Wildlife Resources Commission – Aquatic Wildlife Diversity Section, Western Piedmont Region:

- 2018 will be remembered as a very wet year throughout most of North Carolina. As a result of prolonged high flows, few long-term fish monitoring survey sites were completed and the majority of our work was crayfish and mussel surveys with Duke Energy staff, mostly in their reservoirs.
- Hoping that 2019 will be a drier year, our main priority will be focusing on the fine-scale distribution and genetic make-up of Orange-fin Madtom, *Noturus gilberti*, then other Dan River system state-listed species such as Rustyside Sucker, *Thoburnia hamiltoni*, Bigeye Jumprock, *Moxostoma ariomum*, and Cutlip Minnow, *Exoglossum maxillingua*. Time and weather permitting, additional surveys will be conducted in the middle reaches of the Dan River to locate new populations of Roanoke Logperch, *Percina rex*.

**Texas** Stephan Magnelia (stephan.magnelia@tpwd.texas.gov)

- Restoring Guadalupe Bass - The Guadalupe Bass Restoration Initiative, which started in 2010, continues as a priority project for the Texas Parks and Wildlife Department (TPWD) Inland Fisheries Division. Stockings of pure Guadalupe Bass have brought hybridization rates down to less than one percent in the south Llano River and pure populations have been re-established in the Blanco and San Antonio Rivers. Research studying effects of urbanization on Guadalupe Bass populations in the Colorado River Basin was completed in 2017. In January 2018 a new Guadalupe Bass Conservation Plan was released by TPWD. Efforts to restore Guadalupe Bass have now shifted to the Medina River in the San Antonio River Basin. A 2019 annual report highlighting activities is available. For more information, contact timothy.birdsong@tpwd.texas.gov.
- Use of fine-scale population and genetic data to inform Guadalupe Bass restoration stocking – Related to the Guadalupe Bass Restoration Initiative, TPWD continues to work to develop more efficient and effective methods to re-establish pure populations of Guadalupe Bass. A new project was initiated in 2019 to develop improved management and stocking strategies suitable for rehabilitation of Guadalupe Bass populations impacted by Smallmouth Bass introgression. In this project, we will test effectiveness of developed strategies varying fish size and stocking density at a fine spatial scale (i.e., short (~1km) reaches separated by instream barriers). For more information, contact nate.smith@tpwd.texas.gov.
- Watershed Conservation Book - TPWD staff authored or co-authored eleven chapters for the American Fisheries Society Symposium 91 book “Multispecies and Watershed Approaches to Freshwater Fish Conservation”. The book focuses on innovative conservation approaches to restore watershed processes for freshwater fish conservation while simultaneously supporting human needs. For more information, contact timothy.birdsong@tpwd.texas.gov.
- Texas Instream Flow Program - An instream flow report for the middle and lower Brazos River basin was published in June 2018; for six sites, recommendations were made for subsistence flows, base flows, and high flow events to address instream flow needs for fish, mussels, riparian areas, water quality, and fluvial geomorphology (i.e., sediment transport and channel maintenance). Instream flow studies have been completed in the Trinity and lower Guadalupe rivers and final reports are expected in 2020. Data from this effort will be used to inform instream flow recommendations for maintaining a sound ecological environment. Study results will be used as best available science for water

management to guide state agencies in managing rivers and streams. For more information, see Texas Instream Flow Program or contact [kevin.mayes@tpwd.texas.gov](mailto:kevin.mayes@tpwd.texas.gov).

- Research to Inform Prescribed Releases for Blue Sucker in the Lower Colorado River, Sabine and Rio Grande - TPWD Inland Fisheries staff collaborated with the TPWD Water Resources Branch, Lower Colorado River Authority, and Texas Tech University on movement, population dynamics, and habitat occupancy studies of the state threatened Blue Sucker. A dissertation based on the lower Colorado River study was completed in January 2019. The upper boundary of population size in the 292-rkm study area was estimated at only 1,089 individuals, and recruitment since 2009 appeared weak. Because of the declining population trend TPWD has continued annual population monitoring with the same methodology used in the collaborative study with Texas Tech. For more information, contact [nate.smith@tpwd.texas.gov](mailto:nate.smith@tpwd.texas.gov).
- Environmental Flows Information Toolkit - TPWD has built a decision support tool, the Environmental Flow Information Toolkit (EFIT), to help develop and prioritize strategies for the protection and restoration of natural flow regimes and water levels in Texas aquatic systems. The web-based geospatial platform incorporates multiple data sources and integrated statistical models to serve critical information on water use, hydrologic alteration, and environmental flow targets to meet conservation objectives. EFIT will enable environmental flow practitioners and stakeholders to communicate and collaborate more effectively to achieve voluntary environmental flow protection and restoration strategies. Initially EFIT encompasses the Great Plains of Texas and will be expanded statewide in 2020. For more information, contact [david.bradby@tpwd.texas.gov](mailto:david.bradby@tpwd.texas.gov).
- BioBlitz Initiative - Since 2013 the TPWD River Studies Program has been collaborating with the University of Texas on bioassessments of rivers and streams adjacent to State Parks and Wildlife Management Areas. This initiative supports management needs of these properties, informs recreational initiatives such as the TPWD's Texas Paddling Trails and River Access and Conservation Area Programs, and guides future research and conservation efforts through TPWD's Native Fish Conservation Area initiative. Bioassessment reports include fish, benthic macroinvertebrate, freshwater mussel, riparian, and instream habitat data, as well as recommendations for improving conditions for aquatic and riparian species and recreational use. The latest bioassessment was completed on the Paluxy River. Bioassessment reports are available on-line at the River Studies Reports page on the TPWD web site. For more information, contact [stephen.curtis@tpwd.texas.gov](mailto:stephen.curtis@tpwd.texas.gov).
- Alligator Gar Research Assessing Inland and Coastal Alligator Gar within Coastal Rivers— Inland Fisheries Division staff continue to focus research on Alligator Gar populations. One study involves identification and estimates of abundance for adult Alligator Gar using side scan sonar in the middle and lower Brazos River. The project will examine Alligator Gar distribution and habitat characteristics across the longitudinal gradient of the two Texas river systems. Using these data, scientists will develop predictive relationships between habitat variables and Alligator Gar distribution in river systems and quantify and compare dynamic rates of Alligator Gar collected from upstream (inland) and downstream (coastal) reaches of the lower Brazos River. For more information, contact [clint.robertson@tpwd.texas.gov](mailto:clint.robertson@tpwd.texas.gov).
- Recovery of habitat and fish assemblage in the Llano River following a flood— Following a large-scale flood in the Llano River watershed in October 2018, TPWD

Inland Fisheries Division staff began a project to compare post-flood habitat availability and fish assemblage structure to pre-flood conditions that were documented in the preceding decade. The project will also assess the resilience of the assemblage with a focus on Guadalupe Bass, a species of greatest conservation need and also important to local recreational fisheries. Data collected in this project will help inform what, if any, actions might be taken to restore habitat or fish populations following a large flood. For more information, contact [preston.bean@tpwd.texas.gov](mailto:preston.bean@tpwd.texas.gov).

- Recovery of Macroinvertebrate Communities After Flooding Events in the Blanco, Colorado, and Llano Rivers - The objective of this study is to understand the effect of a catastrophic flood event on various macroinvertebrate taxa, and to track the recovery of the macroinvertebrate communities until they stabilize. For more information, contact [archis.grubh@tpwd.texas.gov](mailto:archis.grubh@tpwd.texas.gov).
- Collaborative Research to Inform Conservation Decisions for Imperiled Freshwater Mussels - In 2010, 15 of the 52 identified freshwater mussel species that occur in Texas were listed as state-threatened. Since that time, research to fill critical knowledge gaps for managing populations of these species has been a focus of TPWD. In the past three years alone, TPWD has collaborated with the United States Fish and Wildlife Service to fund approximately \$1 million in State Wildlife and Section 6 program grants for freshwater mussel research. For more information, contact [clint.robertson@tpwd.texas.gov](mailto:clint.robertson@tpwd.texas.gov).
- Maintaining instream flows and building public support for native fish and mussel conservation and river recreation in the Devils River Basin - The Devils River in southwest Texas is a unique desert river and considered the most pristine river in the state. It is home to many imperiled endemic species such as the Devils River Minnow; however, groundwater pumping poses an imminent threat of reduced spring flows. Baseflow reduction would negatively impact many already imperiled species and degrade one of the state's most remote and scenic paddling and angling destinations. TPWD continues to be engaged in a number of technical studies such as groundwater-surface water interaction and fish habitat availability modeling, as well as building relationships with landowners to help ensure the rivers future. For more information, contact [sarah.robertson@tpwd.texas.gov](mailto:sarah.robertson@tpwd.texas.gov).
- Saltcedar Management on the Upper Brazos River – Since 2015, TPWD, in partnership with 50+ local landowners, USFWS Partners for Fish and Wildlife Program, and others, has implemented salt cedar management in the upper Brazos River. Salt cedar infestation poses issues for water, but also degrades habitat for fish and wildlife, including two imperiled fishes. Research studies are underway at sites throughout the upper watershed to evaluate the effects of salt cedar management on water budget, water quality, instream habitat, and riparian plant communities. For more information, contact [monica.mcgarrity@tpwd.texas.gov](mailto:monica.mcgarrity@tpwd.texas.gov).
- River Access and Conservation Areas Program - With more than 95% of the land in Texas privately-owned and the state's population expected to potentially more than double by 2050, the public's access to land for recreational use, especially land close to major urban areas where demand is greatest, is in increasingly short supply. In 2011-2012, TPWD developed the River Access and Conservation Area Program (RACA) to address the need for increased access to the state's rivers and streams. This program has leased 19 public river access sites along the banks of the Brazos, Colorado, Devils,

Guadalupe, Llano, Neches, Nueces, Sabine, and South Llano rivers. These leases provided access to more than 45 miles of new bank and wade fishing opportunities and have increased access to more than 180 additional miles of river. For more information, contact [john.botros@tpwd.texas.gov](mailto:john.botros@tpwd.texas.gov).

- American Eel Study - TPWD is partnering with the University of Texas at Austin, University of Houston-Clear Lake, USFWS, and citizen-science volunteers to assess the status of American Eel in Texas to better inform conservation and management decisions. The primary objectives of this study are to assess the distribution and abundance, habitat use, movement patterns, and population structure (genetics and demographics) of American Eel across all life stages. Field sampling is primarily focused on the Texas Coastal Plain with a concerted effort to collect glass and elver eel using a variety of gear types (including small-mesh fyke nets and eel mops). Most eel collected to date have been female yellow eels; one silver eel was found dead on a Texas beach. No glass eel or elver have been collected despite extensive effort. The non-native nematode, *Anguillicoloides crassus*, has been documented from the swimbladder of American Eel at three locations. For more information, contact [stephen.curtis@tpwd.texas.gov](mailto:stephen.curtis@tpwd.texas.gov).
- Frio River Sand and Gravel Permit Study - Due to an increasing volume of sand and gravel permit requests within the Frio River basin the Texas Parks and Wildlife Department suspended issuance of these permits until a biology and geomorphology (sediment and hydrology) study was completed. Results of the study are to be used to make better informed permitting decisions. The study area covers approximately 26 river miles. This was a collaborative study between TPWD, the Texas Forest Service and Texas Water Development Board. A final report was completed and is available online at the River Studies Report web page on the TPWD web site. For more information, contact [melissa.parker@tpwd.texas.gov](mailto:melissa.parker@tpwd.texas.gov).
- Effects of Energy Production on West Texas Springs - Freshwater springs contribute substantially to the west Texas regions water quantity and quality. These springs are also ecologically important as they provide habitat for numerous rare and federally listed endemic aquatic species. While much of far west Texas has experienced petroleum exploration and production over the last half century a newly discovered gas and oil field in the proximity of the San Solomon Springs complex, has raised concern about the future of flows at the springs. It is estimated that as many as 5,000 new wells, requiring 4-15 billion gallons of water, will be drilled in the next 20 years. This water will likely be pumped from local aquifers. Recommendations for the Biological Community include formulating a routine biomonitoring program to establish baseline conditions and track species status and health as well as supporting federal Recovery Plan and refugia efforts. A biomonitoring plan for San Solomon Spring is available from Chad Norris [chad.norris@tpwd.texas.gov](mailto:chad.norris@tpwd.texas.gov).
- Monitoring Effects of Arundo Management Study - Arundo is a non-native, cane-like perennial grass that grows prolifically along riparian corridors in moist environments in the U.S. It has been shown to negatively influence riparian and instream environments by altering native riparian community composition, reducing riparian arthropod abundance and diversity, possessing higher proportions of non-native compared to native aquatic macroinvertebrates in root wad habitat, increasing modeled channel depth and current velocity and consuming higher amounts of water than native vegetation. Biological and physical habitat monitoring is being conducted in Barons Creek to assess

the effects of herbicide treatment of *Arundo* and the success of native riparian reestablishment on a long-term scale in the Pedernales watershed. The purpose of this study is to compare biological and physical variables through all stages of *Arundo* treatment and riparian recovery to assess herbicide treatment effect on biological communities, riparian plant composition and physical stream habitat. Contact Monica McGarrity [monica.mcgarrity@tpwd.texas.gov](mailto:monica.mcgarrity@tpwd.texas.gov) for more information on this project.

- Development of an Index of Biotic Integrity for Large Rivers in Texas - The Texas Commission on Environmental Quality and TPWD have Indices of Biotic Integrity (IBI) which are relatively effective for identifying and classifying different levels of biotic integrity among fish and macroinvertebrate assemblages in wadeable streams across Texas. An important next step for Texas is the development of IBI's for larger non-wadeable rivers. For more information, contact [gordon.linam@tpwd.texas.gov](mailto:gordon.linam@tpwd.texas.gov).
- Long-Term Assessment of Fish and Freshwater Mussel Community Impacts from a Newly Permitted Wastewater Discharge in the Sabine River - An inter-divisional TPWD team is assessing potential impacts to the Sabine River freshwater mussel community from a wastewater discharge from a new large-scale poultry processing plant. The proposed discharge location is in an area recognized by TPWD as a mussel sanctuary because of the known diversity and abundance of freshwater mussels. Objectives are: 1) Qualitative assessment of mussel community changes upstream and downstream of the wastewater discharge location over four years; 2) Quantitative assessment of mussel community densities and population dynamics; 3) assessment of juvenile mussel growth and survivorship utilizing mussel cages; 4) assess water quality changes; 5) assessment of long term fish community changes associated with potential water quality changes. For more information, contact [marty.kelly@tpwd.texas.gov](mailto:marty.kelly@tpwd.texas.gov).
- Assessment of a Desktop Floodplain Inundation Model Development Process for Biological Studies at a Large Scale - The objective is to compare the accuracy of floodplain inundation models derived from HEC-RAS to GIS derived models utilizing readily available digital elevation models and USGS rating curves. For more information, contact [clint.robertson@tpwd.texas.gov](mailto:clint.robertson@tpwd.texas.gov).
- Development of Instream Flow Requirements through Spawning Habitat Availability for Alligator Gar Recruitment Success in the Lower Guadalupe River - Utilizing the Alligator Gar spawning habitat availability model developed by Texas State University and Alligator Gar year-class strength data developed by Heart of the Hills Fisheries Science staff the objective is to develop high flow pulse recommendations for successful Alligator Gar recruitment success for the Texas Instream Flow Program study on the lower Guadalupe River. For more information, contact [clint.robertson@tpwd.texas.gov](mailto:clint.robertson@tpwd.texas.gov).
- Brushy Creek Creel Survey and Fisheries Management Report - The fish population of Brushy Creek was surveyed in the fall of 2018 and the spring of 2019 using boat electrofishing (lotic portions) and backpack electrofishing (lentic portions) of the system. Roving creel surveys were conducted in fall of 2018 and spring of 2019. There were no known previous creel or angler utilization surveys for the Brushy Creek system. Based on results of these surveys statewide Community Fishing lake regulations were applied throughout the entire creek system within Williamson County. For more information, contact [patrick.ireland@tpwd.texas.gov](mailto:patrick.ireland@tpwd.texas.gov).
- Least Disturbed Streams: An Extension of the Texas Aquatic Ecoregion Project - This project is a continuation of the Texas Aquatic Ecoregion Project that originated in the

early to mid-1980's. During that time period, a coordinated effort with the Texas Commission on Environmental Quality was initiated to sample least disturbed ecoregion reference streams to establish environmental baselines for the development of indices designed to evaluate aquatic life use (report available at: [https://tpwd.texas.gov/publications/pwdpubs/media/pwd\\_rp\\_t3200\\_1086.pdf](https://tpwd.texas.gov/publications/pwdpubs/media/pwd_rp_t3200_1086.pdf)). The overall goal of the current project is to expand, refine, and consolidate the information on streams in Texas that can potentially serve as least disturbed ecoregion reference streams. The project will also contribute data in support of macroinvertebrate metric regionalization and objectives such as nutrient criteria development by providing data on background concentrations of environmental variables. For more information, contact [gordon.linam@tpwd.texas.gov](mailto:gordon.linam@tpwd.texas.gov).

**Virginia:** Steve Powers ([powers@roanoke.edu](mailto:powers@roanoke.edu))

From Mike Pinder at Virginia Department of Game and Inland Fisheries

- Blackbanded Sunfish Distributional Survey - Prior to 2014, only two sites in Virginia's Chowan drainage had confirmed populations of the Blackbanded Sunfish (*Enneacanthus chaetodon*), a state endangered species. Since that time, we set forth to confirm sunfish presence at previously known sites and discover new locations. By examining satellite imagery, we were able to categorize sites as excellent to poor based on the presence of vegetative cover, pond size and proximity to known sunfish populations. Using the invaluable assistance of local Virginia Department of Game and Inland Fisheries biologists, we were able to access 68 sites. For 2019, we were able to find one additional sites in the Blackwater system, Southampton Co. bringing the number of confirmed sites to 14. Future efforts will focus on sampling more high quality sites and to determine potential locations for reintroduction.
- Blotchside Logperch Recovery in the Powell River - Over the last two summers, biologists have continued to move forward with restoration efforts for the Blotchside Logperch (*Percina burtoni*). The Blotchside Logperch is one of three logperch species in Virginia and is listed as a Tier II species in Virginia's Wildlife Action Plan. In Robert Jenkins and Noel Burkhead book Freshwater Fishes of Virginia published in 1994, the species was considered extant in the North Fork Holston and Clinch rivers, both Tennessee River tributaries. However, even though it has been extensively sampled, no specimens were known from the Powell River, a tributary of the Clinch River. In researching its distribution, biologists uncovered collection records by the Tennessee Valley Authority in 1998 and 2007 in Indian Creek, Lee Co., a small tributary of the Powell River, Virginia and Tennessee. These findings provided hope that this population could be used to repopulate the mainstem. Over the last two summers, biologists have sampled seven sites on Indian Creek to better ascertain Blotchside Logperch abundance and distribution. Only six individuals have been found in a 400 m long reach of Indian Creek indicating that the population is extremely small and highly localized. All specimens had a small section of their caudal fin excised to assess their DNA for genetic diversity and population structure. Results of the genetic study indicated that although limited by low sample sizes, frequencies of both mitochondrial cytochrome *b* haplotypes and nuclear DNA microsatellite alleles showed clear differentiation between Clinch River and Indian Creek populations of Blotchside Logperch. The study did not recommend

mixing of individuals between the Clinch River and Indian Creek. Conservation Fisheries Inc. will be surveying the mainstem Powell River and other tributaries to determine logperch presence and assess suitable habitat if reintroduction is deemed necessary.

- Hazel River Post Dam Removal Fish Survey - Between June 18 and 20, 2019, the Virginia Department of Game and Inland Fisheries conducted a fish survey on the Hazel and Thornton rivers, Rappahannock Drainage, Culpeper County, Virginia. The purpose of the survey was to determine the impact of the removal of a low-head dam on fish species richness and distribution in a Piedmont stream. Monumental Mills Dam was built with hand-mortared field stone circa 1850 on the Hazel River and was modified circa 1930 (concrete crest added) to produce hydro-electricity. There had been a dam impeding fish movement at this site as early as 1816. The 150+ year old dam was removed in 2016 by the VDGIF in partnership with the USFWS to improve fish passage. Four years prior to its removal, the Department surveyed the fish assemblage on the Hazel River above and below the dam. We also surveyed fish on the Thornton River, which joins the Hazel River approximately 0.6 km downstream of the dam. Because the Thornton is about the same size as the Hazel, it served as an undammed control for the study. In 2012, we collected 24 species in the Hazel above and 34 below the dam. During our resampling this year, we collected 28 species above and 34 below. The most notable finds above the dam were the first recorded observations of Sea Lamprey (*Petromyzon marinus*) and Channel Catfish (*Ictalurus punctatus*).
- Population Genetic Differentiation of Clinch Dace and Barriers to Suitable Habitat - In 1999, Clinch Dace (*Chrosomus* sp. cf. *saylori*) was discovered in the Tennessee drainage of Virginia. Subsequent sampling of southwest Virginia and portions of Tennessee indicated that Clinch Dace populations are small, fragmented, and of questionable viability. Further, riparian land use and mining pose significant threats to critical habitat. As such, Clinch Dace were listed as a Federal Species of Concern and on Virginia's Wildlife Action Plan as Tier I - Critical Conservation Need. A management plan and species description for Clinch Dace is of utmost importance, but data on distribution and life history are needed before these objectives can be realized. The objectives of this study were to: 1) Monitor known populations of Clinch Dace to characterize at fine-scale distribution and status. The latter will be addressed in terms of relative abundance. 2) Analyze distribution data using geographic information systems and other approaches to identify habitat and landscape features that isolate Clinch Dace and associated fish populations, 3) Map stream crossings and assess likely barriers to upstream passage and measurements of specific conductance, 4) Screen molecular genetic markers in order to define demographic and any evolutionarily significant units for the species. Virginia Tech sampled 29 reaches on 10 streams for fish with a three-pass depletion method and measured eight habitat variables which might inform conservation actions. They also conducted statistical analyses on six habitat and fish community variables to determine whether habitat rather than fragmentation was influencing Clinch Dace presence and abundance. Seven Clinch Dace populations vary in their degree of isolation, with some populations showing signs of recent admixture and others not. Populations with the least admixture, such as Hurricane Fork and Hart Creek in Russell County, may represent distinct management units. However, they are also among the largest populations found in 2017 and may therefore be the best candidates for donor population for translocations.

The effects of road crossings in our study area were minimal and most crossings were not obvious barriers to fish passage. Instream habitat metrics that we measured also seemed to have little effect on Clinch Dace presence and abundance. Researchers recommended that further management actions be taken with an adaptive management approach, as it is not clear from our results that translocations should be ruled out, but rather undertaken initially as a pilot study with follow-up monitoring to determine whether outbreeding depression is taking place as a result of moving locally adapted fish. Stream restoration activities may not be warranted, as the Clinch Dace shows some resilience to habitat degradation, such as sedimentation and lack of woody debris. Only one culvert on Hart Creek, which could be considered for a retrofit, did not seem to be acting as a barrier to Clinch Dace movement. Further research could measure temporal changes in abundance and characterize the relationship between population size and extinction risk and identify minimum viable population thresholds. Further monitoring should include the seven populations characterized as well as nine streams (Hess, Indian, Laurel, Left Fork Coal, Mudlick, Pine, Town Hill, and West Fork Big Creeks).

- eDNA Identification of Suitable Refuge Habitats for Roanoke Bass in Virginia - In order to help support decision-making about future translocation activities for Roanoke Bass (*Ambloplites cavifrons*), the Virginia Department of Game and Inland Fisheries has contracted Dr. Jamie Roberts, Southern Georgia University, to use a combination of field and molecular methods to improve its current distribution of the Roanoke and Dan basins of Virginia. Molecular sequence data has been compiled for both Roanoke and Rock (*A. rupestris*) bass and other related, co-occurring species, and identified candidate regions for molecular primer design. Several primer sets and screen genomic DNA from target and non-target species to assess primer sensitivity and specificity have been designed. Water samples for eDNA analysis have been collected from a range of stream reaches in the targeted basins. In the summer of 2019, 11 sites that were known for either one or both *Ambloplites* species, were sampled with backpack and boat electrofishers (depending on site depth). The study used a temporal replicated sampling design (two visits to each site) that allows for independent estimation of detection probability ( $p$ ) and occurrence probability ( $\Psi$ ). Fin clips were collected on a subsample of *Ambloplites* specimens to “ground truth” eDNA findings. In 2020, an additional 16 streams with unknown records of *Ambloplites* species in the Dan basin will be sampled using the same techniques.
- Yellowfin Madtom Recovery in the North Fork Holston River - The North Fork Holston River (NFHR), a tributary of the Tennessee River drainage in Virginia has a designation of experimental/nonessential for the Yellowfin Madtom (*Noturus flavipinnis*). The Yellowfin Madtom is a federally endangered and historically occupied the NFHR in the last 1800’s. Between 2016 and 2019, a total of 1,217 Yellowfin Madtoms have been raised and released by Conservation Fisheries, Inc, Knoxville at two NFHR sites. All specimens are marked using a fluorescent elastomer that varies in color depending of the cohort. Among the released specimens, 20 recaptures have been detected in annual monitoring efforts. While no young of year have been found, two nests with viable eggs were uncovered in 2018. The most persistent challenge in YFM recovery in the NFHR is sedimentation caused by unrestricted cattle access.

Steve Powers at Roanoke College is continuing investigation into microhabitat of fishes in the Roanoke River resulting in the following publication: Spruill, D.R., and S.L. Powers. 2019. Microhabitat Comparison of *Percina roanoka* (Roanoke Darter) and *Percina nevisense* (Chainback Darter) in the Roanoke River. Virginia Journal of Science. 70:1-7.