ANNUAL PROCEEDINGS
of the
TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY

Conroe, Texas

17-19 January 2013

Volume 35

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.

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ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER AMERICAN FISHERIES SOCIETY

Annual Meeting
17-19 January 2013
Conroe, Texas

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2013

Published by:
Texas Chapter, American Fisheries Society
c/o Texas Parks & Wildlife Department
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Abstracts of Posters Presented at the Annual Meeting but not Published in the Proceedings

PAST TEXAS CHAPTER PRESIDENTS AND MEETING LOCATIONS

Date	President	Location
1976		College Station
1976	Ed Bonn	Lake Brownwood
1977	Jim Davis	San Antonio
1978	Bill Rutledge	San Marcos
1979	Bobby Whiteside	College Station
1980	Richard Noble	Arlington
1981	Charles Inman	Austin
1982	Gary Valentine	Kerrville
1983	Don Steinbach	Lake Texoma, OK
1984	Gary Matlock	Port Aransas
1985	Maury Ferguson	Junction
1986	Brian Murphy	San Marcos
1987	Joe Tomasso	Kerrville
1988	Dick Luebke	Abilene
1989	Mac McCune	San Antonio
1990	Bobby Farquhar	Lake Texoma, OK
1991	Gene McCarty	Galveston
1992	Bill Provine	Kerrville
1993	Barbara Gregg	Port Aransas
1994	Loraine Fries	Lake Travis
1995	Pat Huston	College Station
1996	Mark Webb	Pottsboro
1998	Katherine Ramos	Athens
1999	John Prentice	Corpus Christi
2000	Paul Hammerschmidt	Bossier City, LA
2001	Charles Munger	San Marcos
2002	Gordon Linam	Junction
2003	Gene Wilde	Galveston
2004	Gary Garrett	College Station
2005	Fran Gelwick	Grapevine
2006	Dave Terre	San Antonio
2007	Debbie Wade	Lake Jackson
2008	Art Morris	Junction
2009	Tim Bonner	Fort Worth
2010	Brian Van Zee	Athens
2011	Ken Kurzawski	San Marcos
2012	Craig Bonds	Galveston
2013	George Guillen	Conroe

TEXAS CHAPTER AWARDS RECIPIENTS

1977 Fish Culture - Don Steinbach (TAMU)
Fisheries Management - Edward Bonn (TPWD)
Fisheries Administration - David Pritchard (TPWD)
Fisheries Research - John Prentice and Richard Clark (TPWD)

1978 Fish Culture - Pat Hutson (TPWD)
Fisheries Education - Clark Hubbs (UT)
Fisheries Research - Clark Hubbs (UT)
Special Recognition - Edward Lyles (USFWS)

1979 Fish Culture - Robert Stickney (TAMU)
Fisheries Education - Richard Noble (TAMU)
Fisheries Management - Gary Valentine (SCS)
Fisheries Research - Phil Durocher (TPWD)
Special Recognition - Charles Inman (TPWD)

1980 None

1981 Fish Culture - Billy White (TPWD)
Fisheries Education - Bobby Whiteside (TXSTATE)
Fisheries Management - Steve Smith (TUGC)
Fisheries Research - Al Green (TPWD)
Special Recognition - Jim Davis (TAMU)

1982 Fish Culture - Roger McCabe (TPWD)
Fisheries Research - Clell Guest (TPWD)
Special Recognition - Bob Hofstetter (TPWD)

1983 Special Recognition - Robert Kemp (TPWD)

1984 None

1985 Fisheries Education - Donald Wohlschlag (UTMSI)
Fisheries Research - Connie Arnold (UTMSI)

1986 Fisheries Management - Billy Higginbotham (TAES)
Fisheries Research - Robert Colura (TPWD)

1987 Fish Culture - Kerry Graves (USFWS)
Special Recognition - The Sportsmen's Club of Texas
Best Presentation - Kerry Graves (USFWS)

1988 Honorable Mention (culture) - Loraine Fries (TPWD)
Fisheries Research - Gary Garrett (TPWD)
Special Recognition - Kirk Strawn (TAMU)
Best Presentation - Joe Fries (USFWS)
Honorable Mention (presentation) - Catherine Dryden (TAMU)

1989 Fish Culture - Robert Vega (TPWD)
Fisheries Management - Joe Kraai (TPWD)
Fisheries Administration - Gary Matlock (TPWD)
Fisheries Research - Roy Kleinsasser and Gordon Linam (TPWD)
Honorable Mention (research) - Bob Edwards (UTPA)
Best Presentation - Robert Smith (TAMU)

1990 Fish Culture - Glen Alexander and David Campbell (TPWD)
Fisheries Management - Dave Terre (TPWD)
Fisheries Administration - Gene McCarty (TPWD)
Best Presentation - Joe Kraai (TPWD)
Scholarships - Tommy Bates (TAMU:1989), Michael Brice (TTU)

1991 Fish Culture - Jake Isaac (TPWD)
Fisheries Management - Mark Webb (TPWD)
Fisheries Administration - Pat Hutson (TPWD)
Fisheries Research - Ronnie Pitman (TPWD)
Special Recognition - The Wetland Habitat Alliance of Texas
Best Presentation - Mark Stacell (TPWD)
Scholarships - Jim Tolan (TAMUCC), Michelle Badough (TXSTATE)

1992 Fish Culture - Camilo Chavez (TPWD)
Fisheries Education - Brian Murphy (TAMU)
Fisheries Management - Ken Sellers (TPWD)
Fisheries Research - Bob Colura (TPWD)
Special Recognition - Bobby Farquhar, Andy Sansom, and Rudy Rosen (TPWD)
Best Presentation - Maurice Muoneke (TPWD)

1993 Fisheries Management - Bruce Hysmith (TPWD)
Special Recognition - Joe Martin and Steve Gutreuter (TPWD)
Best Presentation - Jay Rooker (UTMSI)
Scholarships -Erica Schlickeisen (TXSTATE), Brian Blackwell and Nancy McFarlen (TAMU)

1994 Fish Culture - Ted Engelhardt (TPWD)
Fisheries Management - Steve Magnelia (TPWD)
Fisheries Administration - Dick Luebke (TPWD)
Special Recognition - Bob Howells (TPWD)
Best Presentation - Travis Kelsey (TXSTATE)
Scholarships - Kathyrn Cauble (TXSTATE), Howard Elder and Kim Jefferson (TAMU)

1995 Fish Culture - Robert Adami (TPWD)
Fisheries Education - Bill Neill (TAMU)
Fisheries Management - Spencer Dumont (TPWD)
Fisheries Administration - Roger McCabe (TPWD)
Fisheries Research - Maurice Muoneke (TPWD)
Special Recognition - Tom Heffernan and Robin Reichers (TPWD) S. Ken Johnson (TAMU)
Best Presentation (s) - Robert Weller (TTU), Robert D. Doyle (ACE)
Scholarships - Jay Rooker (UTMSI), Robert Weller (TTU), Gil Rosenthal (UT), John Findiesen and Karen Quinonez (TXSTATE)

1996 Fisheries Education - Billy Higginbothan (TAMU)
Fisheries Management - Gary Garrett (TPWD)
Fisheries Administration - Gene McCarty (TPWD)
Fisheries Research - Ivonne Blandon (TPWD)
Special Recognition - Reeves County Water Improvement Board
Best Presentation (s) - Craig Paukert (OSU), Gene Guilliland (ODWC)

Scholarships - Chad Thomas (TXSTATE), Anna-Claire Fernandez (UTMSI), Kenneth Ostrand (TTU), Dawn Lee Johnson
Technical Support - Jimmy Gonzales (TPWD)
Honorable Mention (technical support) - Eric Young (TPWD)

1997/8 Fish Culture - Tom Dorzak (TPWD)
Fisheries Education - Robert Ditton (TAMU)
Special Recognition - Fred Janssen, Chris Cummings, Dan Lewis, Dan Strickland, and Gary Graham (TPWD), Jim Davis (TAMU)
Best Presentation (s) -Timothy Bonner (TTU) and Gene Wilde (TTU)
Scholarships - Tony Baker and Allison Anderson (TAMU), Patrick Rice (TAMU-Galveston), Laurie Dries (UT)

1999 Fisheries Administration - Lorraine Fries (TPWD)
Special Recognition - Pat Hutson (TPWD, retired)
Best Presentation (s) - Gene R. Wilde and Kenneth G. Ostrand (TTU)
Scholarships - Scott Hollingsworth and William Granberry (TTU), Brian Bohnsack and Michael Morgan (TAMU)

2000 Fisheries Research - Gene R. Wilde (TTU)
Best Presentation - J. Warren Schlechte, coauthors - Richard Luebke, and T.O. Smith (TPWD)
Best Student Presentation - Scott Hollingsworth, coauthors - Kevin L. Pope and Gene R. Wilde (TTU)
Special Recognition - Emily Harber, Joe L.Hernandez, Robert W. Wienecke, and John Moczygemba (TPWD), Joe N. Fries (USFWS)
Scholarships - Mandy Cunningham and Calub Shavlik (TTU), Laurieanne Lancaster(SHSU)

2001 Fisheries Administration - Ken Kurzawski (TPWD)
Fisheries Education - Kevin Pope (TTU)
Fisheries Management - Brian Van Zee (TPWD)
Fisheries Research - Reynaldo Patino (TTU)
Fisheries Student - Timothy Bonner (TTU)
Technical Support - David DeLeon (TPWD)
Special Recognition - Rhandy Helton, Rosie Roegner, and Walter D. Dalquest (TPWD)
Best Presentation – Jason Turner, coauthors – Jay Rooker and Graham Worthy (TAMUG), and Scott Holt (UTMSI)
Scholarships, Undergraduate - Mandy Cunningham, and Cody Winfrey (TTU)
Scholarship, Graduate - Abrey Arrington (TAMU), and Laurianne Dent (SHSU)

2002 Fisheries Administration – Leroy Kleinsasser (TPWD)
Fisheries Management – Gordon Linam (TPWD)
Special Recognition – Raymond Mathews, Jr. (TWDB), Austin Bass Club of the Deaf
Best Presentation – Jay Rooker, coauthors – Bert Geary, Richard Kraus, and David Secor (TAMUG)
Best Student Presentation – J. P. Turner, coauthor – Jay Rooker (TAMUG)
Best Poster Presentation – Michael Lowe, Gregory Stunz, and Thomas Minello (NMFS)
Scholarships, Undergraduate – Felix Martinez, Jr. (TTU), Stuart Willis (TAMU)
Scholarships, Graduate – Mathew Chumchal (TCU), Michael Morgan (TAMU)

2003 Fisheries Culture – Dennis Smith (TPWD)
Fisheries Education – Gene Wilde (TTU)
Fisheries Student – Christine Burgess (TAMU)
Special Recognition – Larry McEachron (TPWD)
Best Presentation – Gregory Stunz (TAMUCC), coauthors Thomas Minello and Phillip Levin (NMFS)
Best Student Presentation – Monte Brown, coauthors Felix Martinez Jr., Kevin Pope, and Gene Wilde (TTU)
Best Poster Presentation – Suraida Nanez-James (TAMUG) and Thomas Minello (NMFS)

2004 Fisheries Culture - Lisa Griggs (TPWD)
Fisheries Education - Timothy Bonner (TXSTATE)
Fisheries Research - Dave Buckmeier (TPWD)
Fisheries Student - Casey Williams (TXSTATE)
Special Recognition - Deborah Wade (TPWD)
Best Presentation - Richard Kraus and David Secor (TAMUG)
Best Student Presentation - Tracy Leavy, coauthor Timothy Bonner (TXSTATE)
Best Poster Presentation - Brian Scott and Gary Aron (TXSTATE)

2005 Fisheries Administration – Roger McCabe (TPWD)
Fisheries Management – Todd Driscoll (TPWD)
Fisheries Student – Bart Durham (TTU)
Special Recognition – Jimmie Green (TPWD) and Kirk Green
Special Recognition – The Patsy B. Hollandsworth Family Foundation
Best Presentation – Gregory Stunz (TAMUCC), and coauthors Jay Rooker (TAMUG), Joan Holt and Scott Holt (UT)
Best Student Presentation – Julie Hulbert, and coauthors Timothy Bonner and David Pendagrass (TXSTATE), and Joe Fries (National Fish Hatchery – San Marcos)
Best Poster Presentation – Michael Baird (TPWD)
Scholarships, Undergraduate – Brian Bartram (TAMUCC), John Putegnat (TAMU)
Scholarships, Graduate – Megan Fencil (UTMSI), Casey Williams (TXSTATE)

2006 Fisheries Education – Kevin Pope (TTU)
Fisheries Management – Dave Terre (TPWD)
Fisheries Research – Loraine Fries (TPWD)
Technical Support – Todd Robinson (TPWD)
Special Recognition – Bruce Hysmith (TPWD)
Special Recognition – Joan Glass (TPWD)
Best Presentation - Richard Kraus and David Secor (TAMUG)
Best Student Presentation - Tracy Leavy, coauthor Timothy Bonner (TXSTATE)
Best Poster Presentation - Brian Scott and Gary Aron (TXSTATE)
Scholarships, Undergraduate – Chris Arredondo (TAMUCC), Josh Perkin (TXSTATE)
Scholarships, Graduate – Bart Dunham (TTU), Casey Williams (TXSTATE)

2007 Fisheries Administration – Larry McKinney (TPWD)
Fisheries Culture – Gary Garrett (TPWD)
Fisheries Management – Charlie Munger (TPWD)
Fisheries Research – Gary Garrett (TPWD) and Bob Edwards (UTPA)
Fisheries Student – Chris Chizinski (TTU)
Honorable Mention (Fisheries Student) – Brad Littrell (TXSTATE)
Technical Support – Reynaldo Cardona (TPWD)
Special Recognition – Robert Howells (TPWD)
Special Recognition – Fred Janssen (TPWD)
Special Recognition – Craig Scofield (TPWD)
Special Recognition – Sandy Henry (Science Spectrum, Lubbock)
Best Presentation – Craig Bonds, coauthors John Taylor and Jeremy Leitz (TPWD)
Best Student Presentation – Matthew Chumchal (OU), coauthors Michael Slattery, Ray Drenner, Matthew Drenner and Leo Newland (TCU)
Best Poster Presentation – Richard Ott and Timothy Bister (TPWD)
Scholarships, Graduate (M.S.) – Brian Bartram (Baylor)
Scholarships, Graduate (Ph.D.) – John Froeschke (TAMUCC)

2008 Fisheries Administration – Lance Robinson (TPWD)
Fisheries Education – Andre M. Landry, Ph. D. (TAMUG)
Fisheries Research – Bart Durham (TTU)
Fisheries Student – Preston Bean (TXSTATE)
Honorable Mention – Zachary Shattuck (TXSTATE)
Technical Support – Corey Clouse (TPWD)
Special Recognition – Chad Thomas (TXSTATE)
Best Presentation – Matthew Chumchal (TCU)
Best Student Presentation – Rodney Gamez (TAMUCC)
Best Poster Presentation – James Tolan (TPWD)
Scholarships, Undergraduate – JoHanna Weston (UD)
Scholarships, Graduate (M.S.) – Megan Bean (TXSTATE)
Scholarships, Graduate (Ph.D.) – Preston Bean (TXSTATE)

2009 Fisheries Administration – Phil Durocher (TPWD)
Fisheries Education – Michael Masser (TAMU)
Fisheries Research – Ray Drenner (TCU)
Fisheries Student – Joshuah Perkin (TXSTATE)
Honorable Mention –
Fisheries Management – John Moczygemba (TPWD)
Technical Support – Mike Gore (TPWD)
Special Recognition –
Best Professional Presentation – Ray Drenner (TCU)
Best Student Presentation – Ted Valenti (BAYLOR)
Best Professional Poster Presentation – Pat Bohannon (TPWD)
Best Student Poster Presentation – Brianne Kiester (TCU)
Scholarships, Undergraduate – Michelle Parmley (TXSTATE); Nicholas Bertrand (TXSTATE)
Scholarships, Graduate (M.S.) – Joshuah Perkin (TXSTATE)
Scholarships, Graduate (Ph.D.) – Bridgette Froeschke (TAMUCC)
Clark Hubbs Research Award – Ben Labay (TXSTATE)

2010 Fisheries Administration – Mike Ray (TPWD)
Fisheries Research – Aaron Barkoh (TPWD)
Fisheries Culture – Hugh Glenewinkel (TPWD)
Fisheries Student – Ben Labay (TXSTATE)
Fisheries Management – Richard Ott (TPWD)
Special Recognition – Mandy Scott (TPWD)
Best Professional Presentation – Michael Tobler (TAMU)
Best Student Presentation – Ben Labay (TXSTATE)
Best Professional Poster Presentation – Mike Stahl (TPWD)
Best Student Poster Presentation – Ben Labay (TXSTATE)
Scholarships, Undergraduate – Jake Wimberly
Scholarships, Graduate (M.S.) – Laura Bivins
Scholarships, Graduate (Ph.D.) – Gabriella Ahmadia
Clark Hubbs Research Award – Seiji Miyazono (TTU)

2011 Fisheries Administration – Art Morris (TPWD)
Fisheries Education – Fran Gelwick (TAMU)
Fisheries Culture – Juan Martinez (TPWD)
Fisheries Research – Kristy Kollaus (TXSTATE)
Fisheries Student – Katie Roach (TAMU)
Fisheries Management – Dan Bennett (TPWD)
Technical Support – Danny Lewis (TPWD)
Special Recognition – Craig Bonds (TPWD)
Special Recognition – Carl Kittel (TPWD)
Special Recognition – Brian Van Zee (TPWD)

Best Professional Presentation – David Buckmeier (TPWD)
Best Student Presentation – Sandra Bibiana Correa (TAMU)
Best Professional Poster Presentation – Rae Deaton (SEU)
Best Student Poster Presentation – Jacob Wadlington (TCU)
Scholarships, Undergraduate – Nathan Frey
Scholarships, Undergraduate – Mark Thomas
Scholarships, Graduate (M.S.) – Niki Ragan
Scholarships, Graduate (Ph.D.) – John Mohan
Scholarships, Graduate (Ph.D.) – Judson Curtis
Clark Hubbs Research Award – Carmen G. Montana (TAMU)

2012 Fisheries Administration – Craig Bonds (TPWD)
Fisheries Culture – Chris Thibodeaux (TPWD)
Fisheries Research – Kirk Winemiller (TAMU)
Fisheries Student – Carmen G. Montana (TAMU)
Technical Support – Robert "Bobby" Wienecke (TPWD)
Special Recognition – Seven Coves Bass Club
Special Recognition – TTU-Department of Biology: Gene Wilde, Aaron Urbanczyk, Doug Knabe
Special Recognition – TPWD-River Studies: Kevin Mayes, Clint Robertson, Kevin Kolodzjcyk
Special Recognition – TPWD-Hatcheries: Dale Lyon, Carl Kittel, Daniel Field, Greg Polk
Special Recognition – Kevin Mayes (TPWD)
Best Professional Presentation – Brad Littrell (BIO-WEST)
Best Student Presentation – William Smith (TAMU)
Best Professional Poster Presentation – Raelynn Deaton (SEU)
Best Student Poster Presentation – Dan Fitzgerald (TAMU)
Scholarships, Undergraduate – Ruben Palacios (TAMUCC)
Scholarships, Graduate (M.S.) – Karen Drumhiller (TAMUCC)
Scholarships, Graduate (Ph.D.) – Larissa Kitchens (TAMUG)
Harry Tennyson Scholarship – William Smith (TAMU)
Harry Tennyson Scholarship – Matt VanLandeghem (TTU)
Clark Hubbs Research Award – Steven Curtis (TXSTATE)

2013 Fisheries Administration – Brenda Bowling (TPWD)
Fisheries Administration – Tim Birdsong (TPWD)
Fisheries Education – George Guillen (UHCL)
Fisheries Culture – Jennifer Butler (TPWD)
Fisheries Student – Rebecca Pizano (TAMU)
Fisheries Management – Mark Webb (TPWD)
Technical Support – Bill Hughes (TPWD)
Special Recognition – Randy Rushin (Water Monitoring Solutions)
Special Recognition – East Texas Woods and Waters Foundation
Special Recognition – Kirk Winemiller (TAMU)
Special Recognition – Loraine and Joe Fries (TPWD, USFWS)
Best Professional Presentation – Ashley Oliver (Halff and Associates)
Best Student Presentation – Tiffany Hedrick-Hopper (TTU)
Best Professional Poster Presentation – Kevin Mayes (TPWD), Brenda Bowling (TPWD)
Best Student Poster Presentation – Niki Ragan (SHSU)
Scholarships, Undergraduate – Lindsey Carey (TAMU)
Scholarships, Graduate (M.S.) – Virginia Eaton (TXSTATE)
Scholarships, Graduate (Ph.D.) – Alin Gonzales (TAMUCC)
Harry Tennyson Scholarship – Melissa Giresi (TAMU)
Harry Tennyson Scholarship – Michael Dance (TAMUG)
Clark Hubbs Research Award – Daniel Fitzgerald (TAMU)

Abbreviations:

ACE – Army Corps of Engineers
BAYLOR – Baylor University
NMFS – National Marine Fisheries Service
ODWC – Oklahoma Department of Wildlife Conservation
OSU – Oklahoma State University
SCS – Soil Conservation Service
SEU – St. Edwards University
SHSU – San Houston State University
TAES – Texas Agricultural Extension Service
TAMU – Texas A&M University – College Station
TAMUG – Texas A &M University - Galveston
TAMUCC – Texas A&M University – Corpus Christi
TCU – Texas Christian University
TCEQ – Texas Commission on Environmental Quality
TPWD – Texas Parks and Wildlife Department
TTU – Texas Tech University
TUGC – Texas Utilities Generating Company
TXSTATE – Texas State University – San Marcos
UD – University of Dallas
UHCL – University of Houston – Clear Lake
USFWS – U.S. Fish and Wildlife Service
UT – University of Texas – Austin
UTMSI – University of Texas Marine Science Institute
UTPA – University of Texas – Pan American

TECHNICAL SESSION ABSTRACTS

The Brazos River Authority System Operations Permit, an Attempt to Balance Water Supply Use and Environmental Needs

Dakus Geeslin *(Texas Parks and Wildlife Department, Water Resources Branch, 4200 Smith School Rd., Austin, Texas 78744; 512-389-8734; Dakus.Geeslin@tpwd.state.tx.us)*
Cindy Loeffler *(Texas Parks and Wildlife Department, Water Resources Branch, 4200 Smith School Rd., Austin, Texas 78744)*
David Bradsby *(Texas Parks and Wildlife Department, Water Resources Branch, 4200 Smith School Rd., Austin, Texas 78744)*

In 2004, the Brazos River Authority (BRA) submitted Water Use Permit Application No. 5851 to the Texas Commission on Environmental Quality (TCEQ). The System Operation (SysOp) Permit, as it is known, requests to appropriate water made available through coordinated operation of BRA's existing water rights and reservoirs, in conjunction with unappropriated flows within the Brazos River and its tributaries. The SysOp permit is the largest, most complex water right application the State of Texas has ever seen. The SysOp approach includes most of the Brazos River basin and twelve reservoirs owned and operated by BRA and the U.S. Army Corps of Engineers. This reservoir and river system management is an innovative water supply strategy. However, the implications and complexities the SysOp could have on aquatic resources is substantial. This required comprehensive coordination, planning, and review from the Texas Parks and Wildlife Department (TPWD), BRA, and TCEQ. A Memorandum of Understanding was developed by TPWD and BRA to facilitate cooperation and working together to protect and maintain the environmental health of and recreational opportunities in, the Brazos River basin. Efforts included developing instream flow requirements, reservoir level thresholds and operation needs, water management plan development, and development and implementation of adaptive management strategies to balance water use and environmental needs. Ongoing study efforts and the status of the water right application process are also discussed.

Reservoir Water Levels, Littoral Habitat, and Recreational Access: a Collaboration to Maintain Quality Fisheries in Brazos River Reservoirs

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Daniel L. Bennett (*Texas Parks and Wildlife Department, Inland Fisheries Management District 3C, 11810 FM 848, Tyler, TX, 75707; 903-566-2161; dan.bennett@tpwd.state.tx.us*)
Brian VanZee (*Texas Parks and Wildlife Department, 1601 E. Crest Dr., Waco, Texas, 76705; 254-867-7974; brian.vanzee@tpwd.state.tx.us*)
Tiffany Morgan (*Brazos River Authority, 4600 Cobbs Dr., Waco, Texas, 76710; (254) 761-3151; tiffany.morgan@brazos.org*)
John Tibbs (*Texas Parks and Wildlife Department, 8684 LaVillage Ave., Waco, Texas, 76712; 254-666-5190; john.tibbs@tpwd.state.tx.us*)

Increasing water demands due to population growth and the effects of climate change suggest that maintaining quality littoral habitat and recreational access in reservoirs will become increasingly difficult. To quantify the effects of water-level fluctuation on these factors, we used side-imaging sonar and geographic information systems to determine reservoir-specific water levels at which littoral habitat and recreational access were adversely affected in 11 Brazos River basin reservoirs. Littoral area decreased 30 to 81% with 2- to 4-m reductions in pool height in most reservoirs; losses were greatest in upper reservoir reaches, which typically contained the majority of littoral habitat in each system. Vegetative habitat and coarse substrate availability declined 50% or more with a 2- to 3-m decrease in pool elevation. Relationships between woody habitat availability varied greatly among reservoirs. Fifty percent of boat launches were commonly dewatered with 2- to 3-m reductions in reservoir water level; additional declines of 1 to 5 m resulted in complete loss of recreational access. In partnership with the Brazos River Authority, we used these results to develop reservoir-specific threshold elevations that are desirable for providing quality fish habitat and recreational access during future low-

water periods. Our results will also be used to prioritize future habitat and access enhancement efforts among Brazos River reservoirs.source populations for broodstock used for restoration of Guadalupe bass populations should ideally be from the same drainage as the restored population when non-introgressed populations are available.

Economics of a Lost or Diminished White Bass Run

Stephan Magnelia *(Texas Parks and Wildlife Department, River Studies, Inland Fisheries, POB 1685, San Marcos, TX 78667; 512-754-6844; stephan.magnelia@tpwd.state.tx.us)*
Marcos De Jesus *(Texas Parks and Wildlife Department, Fisheries Management, Inland Fisheries, 505 Staple Rd., San Marcos, TX 78666; 512-353-0072; marcos.dejesus@tpwd.state.tx.us)*
Jeremy Leitz *(Texas Parks and Wildlife Department, Coastal Fisheries, 4200 Smith School Rd., Austin, TX 78744; 512-389-4333; jeremy.leitz@tpwd.state.tx.us)*

White bass, *Morone chrysops*, are a popular sport fish in the southern United States. The spring (February- May) spawning migration or "run" from a reservoir into rivers feeding the reservoir is highly anticipated by anglers. Once white bass enter the river they become concentrated and potential for high catch rates is good. Much of the total annual directed fishing pressure for this species occurs in the river above the reservoir during the spring months. Non-local anglers that visit these fisheries provide economic impact to surrounding communities. Using a creel and mail-out economics survey we estimated the economic impact of white bass anglers fishing in the upper portion of Lake Buchanan, TX, and the Colorado River above the reservoir from March-May 2011. This area is regarded by anglers as having one of the best white bass runs in Texas. Total direct expenditures in the three month survey period resulting from white bass fishing were estimated at US$2,000,000. Ninety-two percent of the expenditures were made by non-local anglers. Due to prolonged drought Lake Buchanan's water level reached an elevation in 2009, 2011 and 2012 where there was a near loss of the river-reservoir connection. Potential for total loss of connectivity will likely increase for Lake Buchanan and many other central Texas reservoirs in the future due to increased demands for water, and climate change. Prolonged loss of river-reservoir connectivity would likely result in lost or weak white bass year classes, ultimately resulting in decreased catch rates during the popular spring fishing period. Loss of angler access to the river from the reservoir could also reduce fishing activity for this species. We explore the potential economic ramifications of decreased angling for white bass due to chronically poor fishing, or loss of access in Lake Buchanan and other Texas reservoirs with popular white bass runs.

Dallas Water Utilities (DWU) Western Dams Rehabilitation Project: Avoiding Take of State-listed Threatened Mussels and Game Fish in the Elm Fork Trinity River through Relocation Efforts

Ashley Oliver *(Halff Associates, Inc., 1201 N. Bowser Rd., Richardson, TX 75081; 214-346-6354; aoliver@halff.com)*
Kimberlie Brashear *(Dallas Water Utilities)*
Jean Krejca *(Zara Environmental LLC)*
Neil Ford *(University of Texas at Tyler)*

During 2012-2013, the City of Dallas, Dallas Water Utilities (DWU) will conduct structural maintenance and rehabilitation on the Carrollton, California Crossing, and Frasier Dams along the Elm Fork Trinity River for the Western Dams Rehabilitation Project in Dallas County, Texas. Due to impacts associated with reconstruction at these locations, mussel surveys and fish recovery and relocation efforts were required prior to construction. Recently, the Texas Parks and Wildlife Department (TPWD) listed 15 native freshwater mussels as "state threatened" species. The Trinity River Basin has been documented to contain six state-listed threatened mussel species; therefore, in-water presence/absence surveys were performed by trained biologists and SCUBA divers prior to reconstruction of these dams. All mussels recovered during survey efforts were visually examined and identified by species, and state-listed mussels were marked with individually numbered tags and PIT tags to facilitate potential future post-relocation monitoring. All mussels were then transported to a previously selected relocation site, and survey results were analyzed and documented. The mussel surveys identified 15 species,

including two state-listed threatened species, the Texas pigtoe (*Fusconaia askewi*) and the Louisiana pigtoe (*Pleurobema riddellii*). Additional mussel surveys at the California Crossing Dam are scheduled for the summer of 2013 during planned dewatering activities. TPWD Aquatic Resource Relocation Plan Guidelines require fish recovery and relocation activities for the dewatering of streams, ponds, reservoirs, stilling basins, and other flood control structures. To complete reconstruction of the California Crossing and Carrollton Dams, cofferdamming and dewatering is necessary. Electrofishing and fish relocation activities were completed at the Carrollton Dam in late 2012, and the same activities will be completed at the California Crossing Dam in the summer of 2013. Over 300 fish were recovered during electrofishing efforts at the Carrollton Dam, including approximately 200 game fish comprised of 8 different species. Furthermore, this work provides a foundation for other studies examining ecological significance of genetic diversity.

Environmental Flows Under Texas Senate Bill 3: Did We Leave Enough Water for the Fishes?

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Senate Bill 3 of the 80th Texas Legislature (2007) created a process to establish standards for environmental flows to be used by the Texas Commission on Environmental Quality (TCEQ) for evaluating new water rights permit applications. Environmental flows are the amount of water (involving magnitude, duration and timing of flow pulses and base flows) required to sustain populations of native species and essential features and processes of fluvial ecosystems that maintain these populations. SB3 required formation of stakeholder groups and science teams for each major basin in the state. Members of the science teams were selected by the stakeholder groups and tasked with accumulating and analyzing available information to recommend environmental flows without concern for potential human needs. Each basin stakeholder group was tasked with reviewing recommendations from its science team as well as relevant information on future human needs for water. Stakeholders were further tasked with providing recommendations that balance the needs of both humans and nature. The TCEQ was tasked with reviewing both sets of recommendations, and, after receipt of public comments, setting provisional environmental flow standards within each basin. Science teams and stakeholder groups also provided recommendation for studies to fill key information gaps. SB3 deliberations have essentially concluded. This presentation will provide a succinct overview of environmental flows recommended during each step of the SB3 process. Almost without exception, the environmental flows recommended by the science teams were significantly, and in many cases severely, reduced by stakeholders and the TCEQ. Some insights will be offered concerning the sociopolitical dynamics that led these outcomes and the implications of these standards for natural resource management in the future.

The Impact of Droughts on Fish Assemblage and Water Quality in the lower Neches River: Implications for Environmental Flow Recommendations

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Concerns have escalated regarding environmental flow regulations of the lower Neches River in times of drought. These concerns primarily surround rising salinity and pollutant levels. The portion of the Neches below the salt-water barrier (located near Beaumont, Texas) receives up to 65 million gallons of paper mill effluent per day; a permitted discharge that is unrestricted during periods of low flow. In order to formulate environmental flow recommendations, fish surveys and water quality analyses, including dissolved oxygen and salinity, were conducted in the lower Neches in fall 2011 (a drought period) and summer 20112. Salinity levels during the fall were relatively high (reaching approximately 15 ppt near the river bottom) while levels during summer 2012 never rose above 1.5 ppt. In the fall, water above the barrier had lower salinity but similar dissolved oxygen (DO) levels compared with water sampled below the barrier; however, DO was lowest in water directly below the barrier. During the summer, water quality samples directly above and below the barrier did not differ but did vary along

the river below the barrier. Gill net surveys conducted during fall 2011 yielded low fish abundance and diversity in comparison with gill net surveys conducted in summer 2012. Results indicate that water quality in the lower Neches below the salt-water barrier deteriorates during times of low flow. This results from lack of dilution of dissolved organic material introduced from the paper mill effluent. It also appears that freshwater flows during drought conditions are insufficient to maintain the current vegetation community in the Lower Cypress Tract. While improving conditions led to an increase in fish retrieval, the deteriorated conditions during the drought period raises concerns for the future of this low land system. Further observations include the analysis of fish and water quality samples collected along the river surrounding the salt water barrier during the summer of 2012.

Evaluation of Multi-decadal Changes in the Nekton Community of the Brazos River Estuary: Potential Influence of Freshwater Inflow

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The Brazos River is a riverine estuary in southeast Texas with little historical data. Research was needed is needed to determine if (1) nekton communities in the lower Brazos River have changed since last rigorously surveyed nearly 40 years ago; (2) how these subtropical communities have changed both temporally and spatially in terms of areas of the river utilized; (3) how these communities were affected by alterations in freshwater inflow and associated water quality variables; and (4) if the lower Brazos River serves as a nursery habitat for juvenile fishes and decapod crustaceans. This data is critically needed by resource managers to understand the impact that has been made on the riverine, estuarine and near shore marine ecosystem due to changes in freshwater inflow and water quality management.

With nekton and water quality samples each month from January-December 2012, we determined that: (1) Since the mid-1970's, the nekton assemblage has a 60% similarity with the current communities; (2) these changes in the nekton community are mostly regulated by freshwater inflow; (3) diversity and evenness have increased under oligohaline conditions; and (4) several mechanisms are likley responsible for these observed patterns including freshwater inflow directly affecting organisms via altered salinity regimes, and indirectly through modification in sediment transport, nutrients and wetland creation. We further discuss the relative influence of freshwater inflow on overall nekton diversity and productivity during short and long time periods and the potential impacts on nearshore marine water productivity and utilization by estuarine and marine organisms.

Predicting the Risk of Toxic Golden Alga Blooms from Cell Density and Environmental Variables

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Golden alga (GA; *Prymnesium parvum*) is a toxigenic, harmful alga that has invaded freshwater systems in North America. Invasions of GA have been especially problematic in Texas and New Mexico, where blooms have caused fish kills that have resulted in considerable ecological and economic losses. Rapid assessment of a bloom's potential impact has not been possible as previous studies have indicated a poor relationship between GA density and ichthyotoxicity. We hypothesized that predictive models of toxicity could be improved by including environmental factors. We constructed *a priori* models that included GA density, water quality, hydrologic, and weather variables as toxicity predictors. Models were evaluated with 10+ years of GA data from four river basins in Texas and New Mexico. Water temperature, depth, and wind direction and speed influenced density-toxicity relationships among all sites. When evaluated at the basin-level, top models included temperature for the Red and Colorado basins and pH for the Brazos and Pecos basins. Cold-fronts influenced density-toxicity relationships in the Brazos and Red river basins, but not in the Colorado or Pecos basins. Reservoir capacity and depth influenced the density-toxicity relationship in the Brazos and Red river basins, but not in the Colorado or Pecos basins.

Overall, these observations suggest (1) toxicity prediction can be improved by including environmental variables, and (2) basin-specific models perform better than global models.

Stream Fragmentation and Drought Legacy Determine Distribution of Burrhead Chub in Subtropical Streams

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Burrhead chub (*Macrhybopsis marconis*) is a species of special concern endemic to subtropical streams in south Texas. We documented life history attributes and historical patterns in abundance and distribution to aid in understanding range-wide declines of the species among the Colorado and Guadalupe-San Antonio river systems. Life history results suggest burrhead chub is a pelagic-broadcast spawning species that lives 2.5 years and spawns multiple clutches during April-September. Review of museum vouchers revealed burrhead chub is now missing from 26% of its historical range, including most fragmented stream sections upstream of impoundments. There was a significant difference (two-tailed t-test; df = 13, t = 3.9, P <0.01) in the size of stream fragments for which burrhead chub is extirpated (mean = 69 km, standard deviation = 106) or still persists (452 km, 279). However, timing of extirpations occurred after fragmentation and coincided with a record drought (1949-1959), when range-wide stream flows during burrhead chub reproductive season were exceedingly low (e.g., <1 m3/s). Furthermore, extensive historical collections taken by Clark Hubbs during 1950-1961 in the Guadalupe River revealed a decline in abundance in upstream reaches as the drought continued. Based on these data, we hypothesize that burrhead chub experienced range-wide declines associated with historical drought conditions that caused reproductive failure in desiccated upstream fragments. Following the drought, stream flows recovered but recolonization by burrhead chub was blocked by impoundments. These results support previous linkages between stream connectivity as well as flow magnitude and the persistence of pelagic-broadcast spawning fish populations. Furthermore, our findings provide insight into the mechanisms driving freshwater fish declines in south Texas and similar regions and highlight potential issues to consider in conservation management approaches (e.g., repatriation following drought; augmenting low flows using reservoirs).

Effect of Elevated Temperature and Salinity on Swimming Endurance of the Western Mosquitofish (*Gambusia affinis*)

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Climate and anthropogenic changes are predicted to increase temperatures and salinities in aquatic systems. These changes may negatively affect a variety of aquatic species. Both factors (temperature and salinity) can affect the physiology of exothermic organisms. By testing swimming performance one can assess the potential impacts of increased temperatures and salinity (specific conductance) on physiology. We used the western mosquitofish *Gambusia affinis* as our study organism. Twenty fish were either exposed to one of two treatments, temperature (23, 26, 30°C) or specific conductance (900, 10,000, 17,000 µS/cm2), and exercised individually in a flume at a water velocity of 0.2m/s. Time to exhaustion was recorded when the fish was no longer able to maintain its' position in the water column and was ejected from the flume. Temperature had no significant effect on time to exhaustion, though specific conductance did (F1, 59=4.4, p=0.04). At the higher and lower specific conductances (900 and 17,000µS/cm2) time to exhaustion (mean # and # seconds, respectively) was significantly less than the control (mean=#s) at 10,000 µS/cm2. Sex had no effect on time to exhaustion for either the temperature or specific conductance trials. Length had a was significant effect on time to exhaustion in the specific conductance trials (F1,59=5.0, p=0.02), with larger fish swimming longer. These results showed consistent swimming performance of *G. affinis* across a seven degreerange of temperature, but decreasing performance with elevated specific conductance (salinity). These tolerances may potentially provide *G. affinis* an advantage over less tolerant native species as climate continues to change and habitats are altered.

Effects of a Dam on the Structure of the Icefish Species Assemblage in Nanyi Lake, Eastern China

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Dams constructed for irrigation have adversely impacted native fish populations worldwide. Although most research has focused on relatively large and long-lived fishes, small short-lived fishes could be even more sensitive to impacts from dams. Here we report results from a long-term investigation of icefishes (Salangidae) in Lake Nanyi in the lower reaches of the Yangtze River Basin. Icefishes typically live for about one year. Surveys were conducted prior to (2001-03) and after (2006-08) construction of a dam that controls the exchange of water between the lake and river. After dam construction, the number of icefish species decreased from five to three, with disappearance of a migratory species (*Hemisalanx brachyrostralis*) and a previously rare species (*Neosalanx tangkhakii*). Overall, icefish biomass increased from 15 to more than 30 metric tonnes. This increase in biomass was strongly influenced by a large increase in the population of *Neosalanx taihuensis* (spring guild), and this subsequently changed icefish assemblage structure by altering relative abundances of the other three species. Average body size of icefishes also declined during this period. It is apparent that the dam inhibited migratory icefishes from reaching important spawning habitats within the lake, which resulted in recruitment failure. Higher and more stable lake water levels following dam construction probably contributed to lower winter mortality and higher larvae survival rate for *Neosalanx taihuensis*. High densities of this species could have negatively impacted the growth rate of all icefishes via competition for food resources. Following dam construction, icefish assemblage structure underwent rapid change indicating that short-lived fishes also are highly vulnerable to impacts from impoundments that alter hydrology and ecosystem connectivity.

Instream Habitat and Biological Responses to Low Flow Conditions in a Semi-arid Karstic Stream

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Low to subsistence flows are natural components of riverine hydrographs and are recommended to be maintained under the Natural Flow Paradigm. In Texas, subsistence flows are hydrologically defined as the 95th percentile of all daily mean flows in a historical hydrograph and biologically defined as discharge necessary to maintain biological communities for a short time period. Objective of this study was to quantify biological and habitat responses of a Texas stream community as the system transitioned from low base flows to subsistence flows with the purpose of assessing if the hydrological definition of subsistence flows is adequate to maintain biological communities. As the lower reach transitioned towards subsistence flows, instream mesohabitats increased in water temperature and conductivity and decreased in current velocity. Changes in biotic indices (CPUE, richness, diversity and evenness) were not detected. Fishes with affinities for specific habitat types (i.e., riffles, runs, pools) maintained similar habitat affinities. However in the lower reach, riffle specialists were restricted to current velocities > 0.6 m/s less than those in the upper reach and run specialists to current velocities > 0.4 m/s less than those in the upper reach. Following subsistence flows, flows within the lower reach ceased and the reach rapidly dewatered. Up to drying, our results suggest that subsistence flows were effective in maintaining biological communities based on the conditions observed and limitations encountered during our period of observations.

Modeling Growth of Juvenile Blue Crabs, *Callinectes sapidus*, in the Wild by Using Coded Wire Tags

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The blue crab (*Callinectes sapidus*) is both ecologically and economically important to the coastal states of the Atlantic and Gulf of Mexico. Although most of blue crab life history has been described, there is still a lack of data concerning crab's growth parameters and patterns in the wild, making it harder to obtain an overall understanding of their population dynamics. Because blue crabs lack hard body parts commonly used to estimate age, such as otoliths and scales, they are difficult to age. Consequently, an age-based growth model cannot be calculated. Instead, incorporating growth increments into the growth model provides a better estimation of population growth parameters. Using micro Coded Wire Tags (CWT), we internally tagged juvenile blue crabs larger than 15 mm. CWT have previously been used to mark blue crabs because they are not shed between ecdysis (Fitz and Wiegart 1991). To compare growth trends of the blue crab in the wild versus in an enclosure, we also documented the growth of 24 blue crabs that were isolated in minnow traps. We fed half of the enclosed individuals weekly to observe the effects of food intake on growth. Using dates and size at mark and recapture events, growth curves were compared using variations of the Von Bertalanffy model, including Fabens, Munro, and Appeldoorn models. Salinity and water temperature are parameters known to influence blue crab's growth rates and were, therefore, monitored throughout the experiment. The effects of these parameters and seasonality on the growth of blue crabs were compared and will be presented.

Gizzard Shad Sound Production

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A large and growing number of fish species has been shown to produce identifiable sounds that are associated with different aspects of their life history such as mate location, mate attraction, spawning, and aggression. We recorded vocalizations made by gizzard shad (*Dorosoma cepedianum*) in response to three stressors. These stressors included low pH (6.5-6), high salinity (9-17 ppt) and high concentrations (10-15 mL/ 75 L) of ammonia hydroxide. There was a positive relationship between number of vocalizations and presence and intensity of stressor. Thus, sound production may serve as a measure of fish stress. In some recording situations, fish sound production decreased when fish were exposed to particularly high toxic conditions. Our results suggest that acoustic monitoring of field sites that contain gizzard shad may act as an "early warning system" for adverse environmental conditions. Furthermore, this may provide opportunities to remedy water quality issues before further impact on valuable game fish or water sources used for human consumption can occur.

Gape Size Influences Seasonal Patterns of Piscivore Diets in Three Neotropical Floodplain Rivers

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We examined diets of four piscivores, two in the order Perciformes (*Cichla temensis* and *C. orinocensis*) and two in the order Characiformes (*Boulengerella cuvieri* and *B. lucius*), from the Cinaruco, La Guardia, and Ventuari rivers in Venezuela throughout the wet-dry seasonal cycle. The four piscivores consumed a

phylogenetically and morphologically diverse group of fishes, reflecting the overall diversity of fish species in these rivers. At the start of the falling-water period, *Cichla* consumed large prey, especially the abundant, migratory, fish of the genus *Semaprochilodus*. As these relatively large prey became depleted during the dry season, *Cichla* tended to consume smaller prey. For *Boulengerella*, gape limitation precluded consumption of larger, seasonally abundant, fishes, and so prey sizes were more consistent throughout the seasonal cycle. Our findings show how prey abundance and gape limitations interact to influence seasonal patterns of predator-prey interactions.

Larval Crappie Densities in Relation to Environmental Variables, Stock Abundance, and Year-class Strength in Arkansas Reservoirs

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We evaluated relationships between larval crappie (*Pomoxis spp.*) densities, environmental characteristics, and stock abundance in six Arkansas reservoirs in 2010 and five reservoirs in 2011. Environmental variables included alkalinity, hardness, conductivity, dissolved oxygen, pH, turbidity, surface area, watershed area, watershed:reservoir area ratio, shoreline development index, mean depth, maximum depth, chlorophyll *a*, and pre-spawn rainfall. Stock and age-0 crappie abundance was determined from fall trap netting in 2010. Peak larval densities ranged from 0.19 to 1.83 fish/m^3 in 2010 and 0.08 to 1.57 fish/m^3 in 2011 for crappie ≤ 8 mm TL. The relationship between environmental variables and peak larval density was modeled using a stepwise multiple linear regression. Peak larval densities were negatively related to the watershed:reservoir area ratio (r^2=0.81, P=0.0144, N=6) in 2010 and shoreline development index (r^2=0.67, P=0.0909, N=5) in 2011. Reservoirs with large watersheds relative to their size may have greater variability in water levels and lower retention time. Low post-winter retention time has been shown to be negatively related to crappie recruitment. Reservoirs with greater shoreline development index have more littoral area relative to their size which has been associated with predator abundance. Largemouth bass (*Micropterus salmoides*) PSD has been shown to be inversely related to crappie PSD and may regulate the abundance of potential spawners. The relationship between stock abundance and peak larval density was evaluated with the Beverton-Holt model (loge R= loge $\alpha S/1+\beta S$). Stock abundance (CPUE of crappie ≥ age-2) in the fall was positively related to peak larval density the following spring (r^2=0.89, P=0.0563, N=4). Age-0 crappie abundance was related to chlorophyll *a* concentrations. Spring larval abundance did not predict abundance of age-0 crappie from fall trap nets and was likely due to differential survival among reservoirs. First year survival of crappies may be enhanced by increased turbidity and chlorophyll *a* levels.

Possible Competition Between Two Congeners; Endangered *Gambusia nobilis* and Invasive *Gambusia geiseri* in a Reconstructed Desert Wetland Habitat Solomon Cienega, Balmorhea State Park, Texas

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Introduced species are currently listed as the second greatest threat to earth's ecosystems and biodiversity. Invasive species can negatively impact natives by predation, competition, and hybridization. In Texas, the Large Spring Gambusia (*Gambusia geiseri*) has been introduced throughout the Chihuahuan Desert. Since its introduction it has successfully invaded many spring habitats, and in some cases it may be competing with a native Gambusia, *Gambusia nobilis*. Within a newly reconstructed desert wetland habitat, recent population data suggest that the invasive species outnumbers the endangered two to one. Additionally, data taken from seasonal gut contents shows a high diet overlap between the two congeners. Both the number of invasives and high diet overlap are indicative of competitive interactions that could possibly be driving down the population of the endangered species. To further test for possible competitive interactions between the two species, we conducted a five week competition study using experimental mesocosms. Herein, I will report on resource availability and fish

growth from this competition experiment. Not only will this study provide insight into competition dynamics within this specific spring ecosystem, it will also contribute to the overall knowledge of invasive species management.

Environmental Influences on the Distribution of Arapaima in Amazon Floodplains

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This study investigated the environmental factors influencing the distribution of the endangered arapaima (*Arapaima spp.*) in floodplains of the Amazon. The abundance of arapaima was found to be positively related to the area and depth of the water column, and hence volume of lakes. Greater depth of water column also was related positively with the abundance and presence of arapaima in connecting channels. The abundance of arapaima was positively related to the connectivity of the lake with other water bodies. The principal reason for arapaima to prefer habitats that are deep, large, and connected to other water bodies appears to be increased survival through lower susceptibility to extreme drought events and increased mobility and availability of food resources. Deeper, larger, and more connected lakes and connecting channels sustain greater arapaima populations; they can now be used to prioritize conservation efforts.

Changes in the Fish Community of the Upper Brazos River, TX, as a Result of an Ongoing Drought

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The upper Brazos River is an intermittent stream in which discharge is primarily influenced by sporadic rainfall. As result of an exceptionally strong La Niña event during 2011, much of Texas, including the Brazos River basin, experienced the drought of record. We have continuously sampled the fish community of the Brazos River since January 2008. This data set allows us to observe the responses of the fish assemblage to the drought and its subsequent recovery. In 2011, samples showed a drastic decrease in the abundance of most cyprinids (from >95% of the assemblage to <15%) and an increase in abundance of cyprinodontids (from <5% to >80%). Many of the cyprinids found in the Brazos River require a flowing river to spawn, and we found no evidence of successful reproduction by these species in 2011, explaining their decreased abundance. In 2012, spring and summer rains kept water flowing in the river throughout most of the spawning season. During this time, we found that, in comparison to 2011, cyprinid abundance increased to >30%, while cyprinodontid abundance decreased to <70%. This indicates that the cyprinids in the river were able to successfully reproduce in 2012, thereby allowing the persistence of some species and bringing the fish assemblage closer to pre-drought conditions.

Variation in Growth of *Lepomis* in the Texas Panhandle

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The Texas Panhandle is a moderately xeric region that is prone to limited water availability. Despite this, a number of drainages support robust fish populations. We explored variation in growth rates for sunfish in this relatively dry region. We sampled for bluegill (*Lepomis macrochirus*), longear sunfish (*L. megalotis*), and green sunfish (*L. cyanellus*) in 2010 at 3 locations in the Texas Panhandle: Pat Murphy Unit in Lipscomb County along the Plum Creek drainage, Gene Howe Wildlife Management Area in Hemphill County along the Candian River drainage, and Matador Wildlife Management Area in Cottle County along the Middle Pease River drainage. Fish

were trapped using seabass traps, hoop nets, modified fyke nets, and seines. Total maximum length was determined for each individual and scales were collected prior to release. Scales were aged by counting annuli with a microprojector, and growth curves were created by plotting age vs. size for each species for each site. Overall 350 bluegill, 62 longear, and 84 green sunfish were captured across the 3 sites. Preliminary results suggest that sunfish at Gene Howe WMA and Matador WMA have similar growth rates. However, sunfish at Pat Murphy Unit had a slightly older age distribution and exhibited faster growth than the other 2 sites. We suspect these differences are largely tied to the stability of the spring fed pools found on the Pat Murphy Unit.

Assessing Fish Communities of Relic Coral Banks off the South Texas Coast

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Community composition and abundances of fish species were examined from three south Texas banks including Baker, Aransas, and Dream banks. These mid-shelf banks are the remnant peaks of drowned coralgal reefs that protrude 1 to 24 m above the surrounding sediment from depths of 68 to 84 m with buried portions extending 20 to 30 m beneath the siliciclastic mud sea floor, a result of Pleistocene deglaciation and subsequent rise in sea level. The complex evolution of these geological legacies gave rise to unique environments in terms of substrate, depth, and distance from shore resulting in distinct reef fish communities relative to extant shallow-water coralgal reef systems. This study documented and compared fish assemblages among these unique and poorly known habitats particularly as fish communities often vary between locations, separated by as little as an interruption in the contiguous structure of the substrate or habitable structure. Enumeration and identification of fish species was accomplished by reviewing video footage from an ROV deployed from the R/V Falkor of the Schmidt Ocean Institute in September 2012. Multiple ROV transects were made across each of the relic banks. Three video recording systems were simultaneously used: a 10x magnified 2-dimensional view and two 3x magnified, 2-dimensional views that could be overlain to create a composite 3-dimensonal image. Fish abundances were standardized (relative percentages) to account for differences in sampling effort among the banks. The numerically predominant fish species were *Chromis insolata, Stegastes sp., Chromis scotti, Pronotogrammus martinicensis, Lutjanus campechanus,* and *Rhomboplites aurorubens*. Baker had the highest species richness (31), followed by Aransas (28), and Dream (23). Community similarity was highest among Baker and Dream banks (68%) and least among Aransas and Dream banks (62%).

Regional Land Use and Local Habitat Affect Fish Richness and Community Structure within the Neches River Drainage

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We conducted a large-scale monitoring study to examine the relative influence of regional watershed characteristics and local habitat variables on fish richness and community structure in the Neches River drainage. We found that regional-watershed variables and local-habitat variables were equally important for predicting the

number of fish species present in a system (richness) as well as the types of species present in the system (community structure). We used these data to predict how land use characteristics may impact local fish assemblages and examined these predictions by monitoring fish assemblages across streams with different land-use characteristics. We found that human activities within the watershed (i.e., human land use) affected local stream habitats, which, in turn, affected fish community structure. Specifically, we found that fish species richness was not affected by degree of land-use within the watershed. However, fish community structure was strongly influenced by land-use, indicating that alterations to the landscape within the Neches River drainage may affect the types of fish species inhabiting a local stream reach. In particular, fish communities in streams with little human activity in the watersheds (low land-use) were dominated by minnows, suckers and darters. Fish communities in streams with much human activity in the watersheds (high land-use) were dominated by sunfish and topminnows. This study illustrates a potential link between activities within the watershed and dynamics of local fish communities within a low gradient, river system and may be used for land management across Gulf coastal drainages.

Triploid Grass Carp Feeding Preferences for Two Recent Invasive Aquatic Plants

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Aquatic vegetation is an important component of most freshwater systems and provides numerous valuable ecosystem services, providing food, habitat and refuge for a variety of organisms. A significant threat to beneficial aquatic vegetation abundant in many United States waterways is the introduction and spread of invasive macrophytes. Invasive aquatic plants degrade water quality, reduce species diversity, alter animal communities and suppress desirable native plants. This research evaluated the potential use of triploid grass carp (*Ctenopharyngodon idella* Valenciennes) as a biological control agent for giant salvinia (*Salvinia molesta* Mitchell) and hygrophila (*Hygrophila polysperma* Anderson), two novel invasive species recently established in Texas waters. Using a controlled mesocosm experiment, maximum consumption rates and feeding preferences were measured. Grass carp were found to be potentially useful in controlling giant salvinia in the preliminary stages of an infestation but seemed an overall poor control option for hygrophila.

Use of Stable Isotope Analyses to Describe Trophic Dynamics of Aquatic Ecosystems in Galveston Bay, Texas

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Food webs in estuarine ecosystems are characterized by omnivory and an abundance of detritivores in addition to seasonal changes in species and physiochemical conditions. Therefore, it is difficult to identify dominant linkages of energy flow in this very complex and dynamic environment. Attempts to construct food webs using stomach content analyses are unsatisfactory because they cannot identify assimilated dietary components. The use of stable isotope analysis, when combined with dietary data, offers a more powerful method for evaluating the trophic classification of an organism. The primary source of productivity is determined through ^{13}C content while the trophic level is determined through ^{15}N. During our study we used dual stable isotope analyses to identify the primary sources and pathways of nutrition and the trophic level for the main species in the Galveston Bay Estuary Ecosystem (GBEE) from five different sub-bays; Christmas, East, Galveston, Trinity, and West Bays. The ^{13}C analysis showed that for the eastern section of the GBEE, the food web supporting the majority of the species was based on a mixture of phytoplankton and epiphytic algae and/or detritus. For the western section of the GBEE, epiphytic algae and/or detritus are very important. Few of the species examined assimilated one basal carbon source exclusively; instead a mixture of sources at each sub-bay appeared to be used. The ^{15}N analysis showed that nutrient cycling in the upper portion of the GBEE is heavily influenced by

anthropogenic sources from the Trinity and San Jacinto Rivers whereas other secondary bay communities including Christmas and West Bay are primarily driven by in-situ production from marshes and seagrass beds. The significance of these findings as they apply to freshwater inflows and nutrient cycling are discussed.

The Effects of Ocean Acidification and Hypoxia on Atlantic Croaker in the Gulf of Mexico

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By the end of this century, the surface ocean pH will be 0.4-0.5 units lower than preindustrial values due to anthropogenic ocean acidification. In addition, farm and urban discharge of nitrogen and phosphorus into the ocean results in the creation of hypoxic "Dead Zones", in which the dissolved oxygen concentration is below 2 mg/L. Since the late 1980's, the size of the Dead Zone in the Gulf of Mexico has more than doubled due to eutrophication. While ocean acidification and hypoxia due to eutrophication have been shown to have negative effects on marine organisms, seldom have the two parameters been examined simultaneously in a controlled setting. Because the parameters are present simultaneously in the Gulf of Mexico, it is necessary to examine both at the same time in order to detect any synergistic or antagonistic effects that one may have on the other. Finally, a significant amount of research has been devoted to the effects of anthropogenic climate change on calcifying organisms, but there is a paucity of information with regards to the effects on fish. This research will focus on Atlantic croaker, an estuarine fish, which play a key role in marine ecosystems throughout the Gulf of Mexico. In our experiment, Atlantic croaker are placed into tanks with pH and oxygen levels lowered to the values projected for a dead zone in the Gulf of Mexico in 2100. Environmental stress upon Atlantic croaker is measured via the examination of otolith rings. We expect to find that fish placed in the 2100 climate change scenario tanks will exhibit signs of environmental stress.

Dynamics of stream fish metacommunities during superseasonal drought

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Population and community dynamics are driven by factors that operate across multiple scales. Metacommunity perspectives address the role of spatial configuration and connectivity of habitats and the movement of organisms across community boundaries on local and regional processes and patterns of biodiversity. Temperate headwater streams experience unique community dynamics as hydrological conditions change dramatically due to seasonal oscillations between flowing and non-flowing conditions. In an ongoing field study, we conducted monthly surveys of fish assemblages from two intermittent streams in north Texas across multiple spatial scales to investigate metacommunity dynamics over time and the impacts of super-seasonal drought. Species richness and abundance were quantified across local and regional scales for comparisons of community structure and alpha, beta, and gamma diversity. Movement of individuals from multiple species was quantified by mark/recapture using visual implant elastomer. We have collected more than 15,000 individuals representing 10 families and 27 species. Local scale richness varied from 0 (dry) to 14 species across all stream locations and sample dates, while total regional richness at the stream level ranged from 19 to 24 species in Hickory Creek and Clear Creek, respectively. Ordination analysis of assemblage structure revealed greater among stream than within stream differences in assemblage structure, spatial segregation between upstream and downstream sites, but similar directions of change in response to drought conditions for both stream metacommunities. Direct gradient ordination identified associations between local environmental factors and fish assemblage structure across space and time. Preliminary movement data suggests varying levels of dispersal between local habitat patches across multiple species during the onset of drought conditions. In our system, community resilience following super-seasonal drought is likely to be severely altered as refugia habitats have been greatly reduced or eliminated and species experience local extinctions over wider areas of the stream network.

Assemblage-level Diversity of Fish Life-history Strategies along Longitudinal Gradients of River Systems

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Population responses to environmental conditions are mediated by life-history strategies, which represent an adaptive suite of inter-correlated reproductive and demographic traits. Trade-offs in adaptive responses to environmental variation are tied to aspects of predictability and scale relative to generation time. In fishes, for example, species exhibit combinations of traits that yield life-history strategies along a continuum between three endpoints (opportunistic, equilibrium, and periodic strategists). For many, if not most, communities, a diversity of life-history strategies along that continuum may be simultaneously present. Using 645 standardized surveys of stream fish assemblages across multiple river basins in the Great Plains of North America and a suite of 14 quantitative life-history traits for 93 species, we examined assemblage-level patterns of life-history diversity. PCA was used to reduce the dimensionality of life-history traits, and three metrics of functional diversity (richness, evenness, and divergence) were calculated using species PC axis scores and relative abundances in each assemblage. Stream size, network structure and watershed characteristics were summarized using GIS. Species richness and the three functional diversity metrics exhibited different (yet complementary) relationships with hydrology and stream characteristics. Stream size/stability was strongly related to species and functional diversity in unique ways. For example, functional richness was highest in intermediate reaches, and declined in both the largest and smallest streams due to reduced abundance of more specialized strategies, whereas functional divergence increased linearly with stream size. In addition to the assemblage-level summary metrics of functional richness, evenness and divergence, the specific composition of life-history strategies along river gradients represented a transition to more periodic and equilibrium species in larger streams. Although assemblages may be comprised by species representing a diversity of life-history strategies, strong gradients in the relative composition and abundance of life-histories were tied to primary attributes of river systems representing a gradient of stochasticity to predictability/stability.

The Effects of Triclosan on Bacteria Counts in the Slime Coat of Atlantic Croaker

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Triclosan is an antibacterial compound that is an ingredient in many personal care products. As it is washed down the drain, it exits into the aquatic environment and may pose a problem for aquatic organisms. Because it is an antibacterial compound we are concerned with its potential detrimental effects on fish bacteria. The fish slime coat contains multiple antibodies and enzymes that can kill unwanted organisms on the fish. Treating the fish with chemicals may cause the slime coat to lose its effectiveness against diseases. We tested the effects of Triclosan on the amounts and types of bacteria present in the slime of Atlantic croaker, an estuarine fish. Our hypothesis was that the amount of bacteria present in fish slime would decrease with exposure to triclosan and that fish that were not exposed to triclosan would maintain the normal types and numbers of bacteria. We chose croaker because they are a relatively common prey fish for other fish and since they live in estuaries they are exposed to triclosan flowing into the aquatic environment. If triclosan negatively affects the bacteria in croaker then it could lead to increased disease in the croaker population. A sick fish would be easier prey and this is why it would potentially affect other predators. A total of 30 croaker were held in individual tanks over a period of two weeks and fed either triclosan-infused pellets, 50 ppm dosage, or regular pellets. Both prior to and immediately after the two week period, a sample of fish slime was taken. We tested 10 µl of slime by weighing it and homogenizing it in PBS, a bacteriostatic solution, and then diluting it. We diluted the bacteria sample with 990 µl of a sterile diluent. After dilution, we placed the dilutions in agar plates. This allowed us to grow the bacteria so that we could identify the types with a microscope and obtain CFU's which we then used to standardize the bacteria counts per µl of fish slime.

The Effects of Triclosan on Reflex Responses and Anti-predator Behaviors in an Estuarine Fish

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Triclosan is a common antibacterial compound found in many personal care products including toothpastes, deodorants, and soaps. Despite partial removal by wastewater treatment plants, an increasing amount of triclosan is entering watersheds where it can have significant effects on aquatic organisms. Even at low levels, triclosan negatively impacts thyroid homeostasis in anurans and fish, and decreases startle responses and activity levels in anurans. The purpose of this research was to investigate the effects of triclosan on reflex responses and anti-predator behavior in juvenile Atlantic croaker (*Micropogonias undulatus*), an estuarine fish. Sixty Atlantic croaker were held in individual tanks and randomly assigned a diet of either normal food pellets or pellets impregnated with 50 ppm triclosan for 14 days. Both prior to and immediately following the exposure period, fish were tested for a suite of reflex action mortality predictors (RAMP) and were subjected to a video-recorded 30 second simulated predator attack. Videos were then analyzed for the specific strategies (run, hide, cut across tank, turn gambit) employed by the fish. We found that fish exposed to triclosan were significantly more likely than control fish to exhibit reflex impairment. Specifically fish lost the dorsal spine erection response, failing to raise their dorsal fin when the fin was flattened. Reflex impairment is correlated with increases in overall fish stress and mortality outcomes. Treated fish also displayed significant shifts in their anti-predator strategies. Triclosan-exposed fish spent significantly more time in their post-exposure test hiding from the simulated predator than fish in the control group. In some cases fish stayed stationary even as the simulated predator touched them. These behavioral effects may have important implications not only for croaker and similar fish species but also for croaker predators such as bottlenose dolphins as contaminated fish may be easier prey, leading to increased predator body burdens.

Effects of Drought on Stream Foodwebs

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Anthropogenic activities are threatening the resilience of ecosystems and the goods and services that human societies depend on. Freshwater ecosystems are particularly imperiled, suffering accelerating and interacting effects of climate change, habitat degradation, alteration of flow regimes, overexploitation and introduction of non-native species. For example, increasing evaporation rates associated with projected atmospheric warming are expected to increase the frequency and magnitude of droughts in North America. Many freshwater ecosystems (e.g. intermittent streams) are characterized by naturally recurring periods of drought and are inhabited by species with diverse adaptations for persisting during drought conditions. However, extreme climatic events, such as the prolonged drought recently experienced in the U.S. southern plains and expected to become more regular and intense under continuing climate change, have dramatic yet poorly understood effects on the structure and functioning of ecosystems. My research objectives are to explore the effects of drought on food-web structure and function in intermittent streams. Specifically, I am interested in temporal food-web dynamics beginning in pre-drought conditions, during drought, and through recovery. I will employ multiple data types, yielding comprehensive information on structure and function of my study systems over time. In addition to providing much needed information on how freshwater food webs respond to climate-induced disturbance, I will also use my dataset to test and advance general mechanistic theories of determinants of food-web structure and dynamics. I will be presenting previous research I have completed in intermittent streams demonstrating how being trapped in an isolated pool can change the community, behavior and morphology of fishes in order to survive. Finally I will conclude with a direction of where my research is heading to address my research objectives in Texas.

Estimating and Reducing Release Mortality in Red Snapper Fisheries

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The red snapper fishery is the most important finfish fishery in the Gulf of Mexico, where red snapper are caught in directed commercial and recreational fisheries and as bycatch in shrimp trawls. Red snapper has been considered overfished in the Gulf of Mexico since the 1980s, and the fishery has been managed by trip limits, bag limits, closed seasons, size limits, and annual quotas. These measures have resulted in the release of undersized, excess, or out of season fish, but not all released fish survive due to barotrauma, or rapid decompression. This talk summarizes the results of projects we have done over the past 10 years to estimate the discard rate and release mortality of red snapper in Texas fisheries, to predict an individual fish's probability of mortality based on their condition at capture, and to reduce release mortality by techniques such as venting and rapid recompression. Our results show that management regulations requiring high levels of discards contributed to overfishing because of high mortality rates of released fish and that values for release mortality were underestimated in previous stock assessments due to delayed mortality. Using controlled lab and field experiments, we found that fish condition was positively correlated with burst swimming speed and inversely correlated with the reaction distance of fish to a simulated predator. Red snapper in intermediate condition were most likely to be eaten by dolphins upon release rather than either impaired or unimpaired fish. Rapid recompression via release hooks did not appear to significantly improve fish survival, and based on CT scans of a related snapper species, the variability in venting results for snapper are likely due to the presence and location of ruptures in the swim bladder of fish, changing the distribution of air inside the fish.

A New Stock Assessment Model for Brown Shrimp (*Farfantepenaeus aztecus*) in the U.S. Gulf of Mexico with Implications for Texas

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NOAA Fisheries is employing a new stock assessment model to assess the status of the Gulf of Mexico brown shrimp (*Farfantepenaeus aztecus*) stocks. This methodology uses Stock Synthesis 3 and is parameterized with state and federal commercial brown shrimp data from 1984-2011. Brown shrimp catch from statistical zones 7-21 has been declining over the time series ($F=10.99$ df=1, 26, $p=0.0027$; $R2=0.30$). Catch averaged 78 million lbs. with 2010 being the record low level with only 45 million lbs. caught. Directed fishing effort has also been decreasing ($F=49.37$ df=1, 26, $p<0.0001$; $R2=0.66$), with the last four years on record averaging only about 45 thousand nominal days fished. Disproportional reductions in catch and effort have resulted in increases in CPUE, with record high levels being estimated in the most recent years of the time series ($F=31.24$ df=1, 26, $p<0.0001$; $R2=0.55$). Catch rates were over 1,400 lbs. per day fished in 2011, which is about four times greater than the lowest CPUE on record. Using these fishery dependent data, and fishery independent surveys from SEAMAP and Louisiana, we assessed the status of the brown shrimp stock. Fits to the CPUE estimates, size selectivity, spawning biomass, numbers of recruits, and fishing mortality estimates were generated. Spawning biomass and recruitment for the 2011 fishing season were 55,614 metric tons and 62.45 billion individuals respectively. Fishing mortality has been decreasing in recent years with estimates of 0.63 and 1.14 derived, for the offshore and inshore fishery respectively, for the 2011 fishing season. Using these results, there is no evidence that the brown shrimp stocks are overfished or undergoing overfishing. Further research is ongoing to increase the precision and tuning of this stock assessment model. We will soon integrate environmental and habitat related growth and mortality indices for marshes in Texas and Louisiana into the model.

Conceptual Framework to Assess the Effects of Wildland Fire on Fishes of the Texas Gulf Slope Drainages

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In Texas, wildfires burned over 3.9 million acres in 2011, including over 828,000 acres of mixed use land that border ecologically significant stream segments. Studies assessing the effects of fire on aquatic communities are limited primarily to northern montane wildlands and might not be applicable to the arid and semi-arid regions of Texas Gulf Slope drainages. To better understand and manage the land-water interactions within the western gulf slope drainages, we propose a conceptual framework to serve as a basis for testing hypotheses on initial, mid and long-term effects of wildland fires on fish communities and for assessing factors that mitigate the effects (i.e., burn intensity, distance from stream reach, resiliency of the aquatic community). Assessments of community responses from two recent fires (Canon Ranch Fire, Independence Creek; Oasis Ranch Fire, South Llano River) suggest fish communities of gulf slope drainages are more resilient to initial effects of wildland fires than fish communities in more montane regions.

A Comparison of the Site Fidelity and Habitat Use of Red Snapper on Two Artificial Reef Types Utilizing Acoustic Telemetry, in South Texas

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Red snapper, *Lutjanus campechanus*, is an important commercial and recreational species along the Gulf Coast making it important to actively monitor their population and trends. Red snapper also tend to congregate where hard structure or substrate can be found. Since the Gulf of Mexico along the Texas coast provides limited natural hard substrate, placement of artificial reefs can provide habitat to many marine species, including red snapper. Such reefs include oil and gas production platforms, sunken ships, concrete culverts, and other reefing materials. Two artificial reef types, the Texas Clipper Reef and the South Padre Island Reef, are unique with respect to depth, reef material and proximity to shore, which allows for a comparison study of site fidelity among red snapper at each reef site. Residency time was estimated for 13 and 19 red snapper using acoustic telemetry and external Floy tags at the Texas Clipper and Port Mansfield sites respectively. To avoid barotrauma and increase survival rate in tagged fish, all surgeries were performed underwater at depths between 20 and 25 m. Data loggers affixed near the artificial reef structures recorded time and depth measurements from the implanted transmitters. Movement patterns were characterized at each site. Additionally, Floy tags were inserted in individuals without internal transmitters to allow for a mark and recapture survey to better understand fishing pressure at each site. This study will indicate which type of reef structure may promote greater site fidelity among red snapper and therefore could serve as a reference for future artificial reef construction along the Texas coast. To date, three Floy tags have been returned by fishermen and the longest residency time recorded has been 67 days.

Evaluating Habitat Associations of a Fish Assemblage at Multiple Scales in a Minimally Disturbed Stream on the Edwards Plateau

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Landscape features at coarser spatial scales tend to limit or influence the structure at finer scales based on the hierarchical classification model of riverine systems. Through various boundary exchanges, coarser scales ultimately dictate the instream habitat structure like patch frequency, patch quality and range of spatial patterns of similar habitat patches. Therefore, understanding the influence that different scales have on instream habitat is essential for accurately quantifying fish habitat associations in a lotic environment. In this study, three scales (e. g. microhabitat, mesohabitat, reach) and multiple environmental variables were used to evaluate the fish assemblage habitat associations in the South Llano River, a spring-fed second order stream on the Edwards Plateau in central Texas, to determine the scales with the most influence on fish assemblage composition and structure. We used a low-cost side scan sonar system to map and classify substrate and other instream habitat features. We then established sampling stations stratified by meso- and microhabitat classes, and sampled the fish assemblage at each station seasonally. We performed canonical correspondence analysis to assess the relationships between the fish assemblage structure, physicochemical conditions, and landscape features. Analysis reveals that fish abundance is the highest within run habitats, however, coarser substrates (e.g. cobble) nested within pool habitats contain the most diverse amounts of fish species. These findings will help provide data on the habitat use patterns of a fish assemblage in a relatively undisturbed system and could potentially help prioritize future restoration efforts for other streams in the region.

Influence of Water Temperature on Fish Distributions within a Texas Spring-fed Stream

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Spring sources and their relatively constant water temperatures (23°C) are predictors of fish distributions and fish community segregation within karst streams in the Edwards Plateau and Rio Grande basins of Texas. Within basins, fish communities are generally segregated between spring habitats with relatively constant water temperatures and riverine habitats with water temperatures more reflective of ambient temperatures. Within spring habitats, fish communities are segregated along physical habitat gradients with water temperature only explaining a minor structuring mechanism. However, variation in water temperatures is minimal in spring run habitats. To elucidate the influence of water temperature on fish distribution and community segregation among a spring run, we assessed movements of the fountain darter and other spring-associated fishes as well as riverine-associated species along a temperature gradient within Spring Lake of the upper San Marcos River. Overall, 3,260 spring fishes were observed with most individuals found in constant temperatures (83% relative abundance) whereas 2,568 riverine fishes were observed with slightly more individuals found in the more variable temperatures (52% relative abundance). Water temperature was associated with seasonal movement of spring fishes and riverine fishes into spring habitats during winter months ($p < 0.01$) and movement outside of spring habitats occurred during summer months. The federally threatened fountain dater was often associated with constant 23°C temperatures but was also observed to move into cooler (17°C) and warmer (25°C) temperatures when available. Results from this study further support constant temperature as a segregating factor within basins and within spring runs but also demonstrates that spring fishes will enter cooler or warmer temperatures when available.

POSTER SESSION ABSTRACTS

Comparison of the Precision of Ages from Three Techniques and Back-calculated Lengths for Introduced Blue Catfish

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Age and growth information is used to understand life history and ecology of catfish populations and monitor their trends. Such information is useful for evaluating the success of establishment of introduced populations. Prior studies have validated age determination methods for various catfishes, but none have been validated for blue catfish. We compared precision of age estimates and back-calculated growth after using one lethal and two non-lethal age determination techniques for introduced blue catfish in Georgia. Blue catfish (n=153) were collected by experimental gillnets set overnight at 12 standardized stations at Lake Oconee, Georgia. Two non-lethal techniques requiring the pectoral spines (articulating process and basal recess) and one lethal technique requiring lapilli were used to determine the ages of the fish. The Frasier-Lee method was used to back-calculate growth for each fish. Hierarchical linear models were used to compare precision of back-calculated length estimates and growth among the three techniques. Two readers found the highest precision for otolith-based age assignments (83.5%) and lowest for basal recess cross-sections (71.4%). The models indicated that back-calculated length was variable among fish from ages 1-3 for the techniques compared; otoliths and basal recesses yielded variable lengths at age-8. Our study suggests the articulating process and otolith techniques would are adequate for age determination of blue catfish.

Effects of Temperature, Salinity, and Suspended Solids on the Development and Buoyancy of Arkansas River Shiner Eggs

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Arkansas River shiner (ARS) *Notropis girardi* is a threatened pelagic broadcast-spawning cyprinid native to the Arkansas River drainage in the Great Plains eco-region. Populations of ARS have declined likely due to alteration and fragmentation of habitat, which limits the ability of ARS to successfully reproduce. However, changes in other physiochemical factors such as temperature, conductivity, and suspended solids, may affect egg buoyancy and developmental rate and thus influence the minimum stream fragment length and current velocities necessary for successful reproduction. We used a full factorial experimental design to assess the effects of temperature, total dissolved solids (TDS), and total suspended solids (TSS) on the buoyancy and developmental rate of ARS eggs and larva. The minimum current velocity necessary to keep ARS eggs in suspension increased with elevated TDS, increased with elevated TSS, but also was inversely related to temperature. Unsurprisingly, developmental rate was primarily correlated to temperature in the range tested (20-28°C). However, TDS and TSS also seem to influence developmental rate. These findings will aid in identifying of areas that can support successful reproduction in pelagic-spawning cyprinids, such as ARS, and provides critical data for developing models predicting the effect of further anthropogenic disturbances.

Evaluations of the Growth and Habitat Use of Guadalupe Bass at a Landscape Scale in the South Llano River, Texas

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Guadalupe bass *Micropterus treculii* is a black bass species endemic to central Texas. Its dependence on undisturbed pool and run habitats with sufficient flow and cover renders it sensitive to habitat alteration. The decline of the species due to habitat alteration/loss and introgressive hybridization with introduced smallmouth bass *Micropterus dolomieu* has prompted efforts to restore Guadalupe bass habitats. However, detailed data on how the species may respond to these efforts are lacking. We assessed age-specific Guadalupe bass habitat associations and habitat specific growth rates in the South Llano River. Substrates were classified using side-scan sonar. Scales and otoliths were extracted from Guadalupe bass to determine age and growth. Over 65% of captured Guadalupe bass were age-2 or age-3, but individuals ranged from 0-7 years of age. Over half of the individuals ≥300mmTL were captured from the bedrock dominated upper reaches of the river, while individuals ≤150mmTL were captured further downstream in shallower pool and run mesohabitats with cobble-gravel substrates. Our results suggest age-specific Guadalupe bass habitat associations that may increase the effectiveness of restoration efforts directed at the species. Further application of these results may allow the use of the Guadalupe bass population trajectories and habitat occupation rates as an indicator of stream health in Edwards Plateau streams or as a predictor of changes in stream condition.

Impacts of Land Use Practices on Community Ecology of Freshwater Mussels in East Texas Rivers

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The impacts of anthropogenic activities such as agriculture, urbanization, and impounding in watersheds have significantly increased the need for methods of stream health evaluation in East Texas. Here, we evaluate two watersheds that exhibit a stream in its natural state, the Cypress Creek, and a stream in a state of severe alteration, the Sulphur River, respectively. To assess the effects alteration of the landscape has on the quality of streams we utilized an animal model known for its sensitivity to changes in the aquatic environment, the freshwater mussel (Unionidae). Freshwater mussels have long been regarded as valuable indicators of lotic system health because they are often the first organisms to exhibit a response to changes in their environment. By comparing GIS derived land use and land cover data to mussel diversity and abundance from each river we can predict the impact that alterations to the landscape may have on the quality of streams. Although species richness was the same in both streams (21 species), species composition differed between these systems. The Sulphur River sites were primarily composed of species that tolerate shifting habitat conditions (e.g. *Lampsilis teres*). The Cypress River exhibited more diversity at each site with decreasing diversity at sites that were impacted by habitat alterations in the surrounding watershed. The Texas Pigtoe (*Fusconia askewi*), a state threatened species, was found in both watersheds and a range extension for the White Heelsplitter (*Lasmigona complanata*) was produced on the lower Sulphur River. Our results suggest that altering habitat in the surrounding watershed of a stream can decrease the quality of stream health.

Captive Spawning and Propagation of Imperiled Broadcast Spawning Cyprinids in Texas

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Large streams and rivers of the Great Plains in the central United States are inhabited by a guild of cyprinds that broadcast spawn semi-bouyant ova into the current. Successful recruitment of these species, thus, requires flowing water. In 2011, an exceptionally strong La Niña event resulted in a drought of record through most of Texas. This drought caused almost complete reproductive failure among these species. In late 2011, we collected adults of several species, including three imperiled species, of fishes presumed to be broadcast spawners to propitiate and develop culture techniques for. All fish were injected with carp pituitary and were either allowed to batch spawn naturally in aquaria or were strip spawned during ovulation. We describe culture and spawning techniques as well as successes and limitations of each. These captive propagation techniques could be useful in the future as many broadcast spawning cyprinids are becoming species of conservation concern due to drought and anthropogenic changes.

Conservation Implications of Introduced Sheepshead Minnow in the Upper Brazos River

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From August 2011 through August 2012, we collected specimens of sheepshead minnow *Cyprinodon variegatus* from three sites in the upper Brazos River located 62, 79, and 108 km upstream from Possum Kingdom Reservoir, Texas. Sheepshead minnow was common at each site. The Red River pupfish *C. rubrofluviatilis*, which is native to the Brazos River, was collected only at the most upstream of these sites. Since August 2012, numerous specimens of *Cyprinodon* showing a combination of morphological traits (coloration, belly scalation) typical of both sheepshead minnow and Red River pupfish have been collected from these three sites. In October 2012, *Cyprinodon* specimens showing a combination of morphological traits typical of both sheepshead minnow and Red River pupfish were collected from fourth site, approximately 152 km upstream from Possum Kingdom Reservoir, which suggests rapid upstream movement of sheepshead minnow and putative hybrids. Previous introductions of sheepshead minnow into Texas waters inhabited by native *Cyprinodon* species have resulted in hybridization between native and introduced species. For example, in the Pecos River, sheepshead minnow hybridized with the endemic Pecos pupfish *C. pecosensis* and, over an approximately five-year period, the Pecos pupfish was replaced by a hybrid swarm throughout some 430 km of the Pecos River. The presence of sheepshead minnow in the upper Brazos River, upstream from Possum Kingdom Reservoir, has important conservation implications. Echelle & Echelle (1992) and Ashbaugh et al. (1994) suggest the Brazos River and Red River forms of Red River pupfish are distinct species. Sheepshead minnow has come into contact with Red River pupfish in the Brazos River, and putative hybrids between the two species now occur at several locations that span at least 150 km of river.

Association between Brown Shrimp (*Farfantepenaeus aztecus*) Catch per Unit Effort and Environmental Variables

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The commercial shrimp harvest is the second most important fishery in the United States, and eighty percent of this harvest by weight is caught in the Gulf of Mexico (GOM). Survival rate in the post larval stage in GOM estuaries is hypothesized to be the most important in determining cohort strength. Previous research has shown that salinity and temperature changes in estuaries during peak recruitment affect shrimp growth, which can affect their survival. If environmental conditions such as tide and discharge affect these conditions and accordingly affect shrimp growth, then environmental factors could be used as a proxy for estimating shrimp populations. Our analysis was performed to test the idea that shrimp abundance is affected by tidal fluctuations and/or river discharge. Tide data were obtained from five NOAA stations within the GOM, stream discharge data were obtained from six major tributary rivers, and SEAMAP catch per unit effort (CPUE) brown shrimp (*Farfantepenaeus aztecus*) data were obtained from 10 statistical zones within the GOM. Correlation analysis was performed between both environmental factors and shrimp data. Preliminary analysis shows some significant association between CPUE data and river discharge as well as between CPUE data and tide. SEAMAP shrimp trawl data was positively correlated with tide data and negatively associated with discharge data, which is consistent with previous knowledge.

Quantification of Glochidia on Host Fishes in the Sabine and Sulphur Rivers in East Texas

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Fish play a vital role in the development of Unionid mussels. A mussel starts its life as an obligate ectoparasite, known as glochidia, which must attach to a fish species to survive. Yet, even with these vital ecological interactions, little is known about fish host specificity among mussel species. Fish collections were made in September 2012 in the Sabine River and in October 2012 in the Sulphur River in East Texas to observe glochidia on their naturally infected fish host. Fish were preserved in 95% ethanol and returned to the lab for further inspection. Under a compound light microscope, glochidia were found on two of the twelve fish species captured in the Sabine and on none of the fish captured in the Sulphur. Sixty-one percent of Red shiners (*Cyprinella lutrensis*) were infected with 27% of the infected fish having 20 or more glochidia, while 14.75% of the bullhead minnows (*Pimephales vigilax*) were infected with 11% of the infected fish having 20 or more glochidia. Morphological features of the glochidia were the same between the two fish hosts. Glochidia were semielliptical, hookless, and attached to gill filaments of the host fish. Morphometrics were taken on measureable glochidia for height, length, and hinge length. The measurements were, respectively, 124 μm, 103.5μm, and 103.5μm. Infected fish gills were preserved in 95% ethanol and further analysis will be conducted, using molecular genetic techniques, to determine the mussel species of the preserved glochidia.

Preliminary Investigations into Salinity Tolerance of Spring System Amphipods

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Amphipods are important components of aquatic ecosystems, and in isolated spring systems of the Trans-Pecos region they can be the dominant benthic biomass. Environmental conditions vary among these springs, with differences in salinity and temperature. Genetic evidence suggests that different spring systems contain different species of amphipods (*Gammarus-pecos* species complex) that have not been formally described. Changing climate and anthropogenic impacts may result in alterations in salinity and temperature of these relatively stable springs. Thus we present preliminary investigations into the tolerance of amphipods to changes in salinity (specific conductance). Amphipods were collected from three spring systems in the Trans-Pecos region of Texas: San Solomon Springs (SS), Independence Creek/Carolina springs (IC), and Diamond Y spring system (DY). Amphipods from each spring were individually placed in glass vials containing water at various levels of specific conductance, and survival was monitored for two weeks. Specific conductance levels tested varied by spring system. For SS and IC all individuals in the control treatments (site specific conductance) survived. Mortality of amphipods from DY was the same across the range of specific conductance tested. For IC amphipods there was some evidence that increasing salinity resulted in increased mortality. Amphipods from SS appeared to be fairly tolerant to a wide range of specific conductance (1.7-12.05 mS/cm2), as there were no clear patterns in SS amphipod survival. Our preliminary results indicate that there may be differences in tolerance among these putative species of amphipods. We plan to conduct additional experimental trials to better describe tolerances (survival and reproduction) to changes in salinity.

Triclosan's Effects on Dominance Behavior

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Triclosan is an antimicrobial compound that can be found in many personal care products such as hand soaps and shampoos. Triclosan enters into aquatic environments, where it can create problems for aquatic organisms. We researched the effects of chemical triclosan, on audio behavior in Atlantic Croaker, an estuarine fish. Atlantic Croaker are not only prevalent along the Gulf Coast, but they also make a low clicking sound, also known as a "croak" when threatened or asserting dominance. Because triclosan is an endocrine disrupting chemical, we hypothesized that triclosan exposed fish would indirectly show decreased levels of behavioral dominance and aggression. To test the effects of triclosan, 15 fish were housed in individual 75-l tanks. The control croaker were fed normal food pellets while the experimental group croaker were given pellets that had been treated with triclosan. Both before and immediately after the exposure period, croaker was tested for potential dominance behavior. Fish were first acclimated to the hydrophone for 5 minutes before the testing began. Then, a large mirror was placed into the tank during feeding times. The fish were then recorded for the next ten minutes, to see how the fish reacted to the "intrusion" of another croaker in their tanks. Preliminary results show that the majority of the fish that have been exposed to triclosan produce a "croak" that is not only smaller in amplitude, but the sound length is significantly shorter Therefore, triclosan exposure may have an effect on the structure of fish populations and aquatic food webs.

Effects of Base Flow and High Flow Pulses on Drifting CPOM, Macroinvertebrates, and Larval Fishes

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Sound ecological environments of aquatic fluvial systems in Texas are currently managed under the theories of the Natural Flow Paradigm. Specifically, natural characters of the historical hydrograph, such as subsistence, base, and pulse flows, are protected by managing water withdrawals and capture. Purposes of this study are to quantify relationship between organic drift (CPOM, macroinvertebrates, and larval fishes) and discharge under base flow conditions and various tiers (i.e., one per season, one per year) of pulse flows in the San Antonio and lower Guadalupe rivers. Information from this study will be used to establish baseline conditions of organic drift, which will provide measures to evaluate further anthropogenic modifications to the base flow and pulse flow within the San Antonio and lower Guadalupe rivers.

Relationships between Surface Water Quality and Golden Algal Blooms in the Pecos River Basin, Texas and New Mexico, USA

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A harmful algal species of increasing concern in inland waters is *Prymnesium parvum* (golden alga, GA). The first reported GA bloom in North America occurred in the Pecos River in 1985, and large-scale fish kills have occurred throughout most of the river since then. Associations between water quality and GA abundance and toxicity may vary among river basins. Thus, basin-specific information is required for successful management of GA. In this study, eight sites were selected along the Pecos River for spatiotemporal assessment of associations between water quality and golden alga. Four of the sites were located in New Mexico and the other four in Texas. The study began on January 2012 and will end on July 2013. Results of classification tree analysis using preliminary data collected through November 2012 showed that alkalinity, specific conductance, magnesium and calcium hardness, temperature, and pH are the variables that best differentiate between GA presence and absence. Presence of GA in the Pecos River seems to be most likely when the following conditions are met: alkalinity < 119.5 mg/L, specific conductance < 17960 µS/cm, Mg hardness > 715 mg/L, Ca hardness < 2406 mg/L, temperature <27.5 °C and pH < 8.25. These results, however, are still preliminary and final conclusions will be available once sampling is completed.

Courtship and Spawning Behaviors of the Guadalupe Bass *Micropterus treculii* in the Texas Hill Country

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The Guadalupe bass *Micropterus treculii* is native to the Texas Hill Country of central Texas (Hubbs 1957). It is distributed across portions of the Brazos, Colorado, Guadalupe and San Antonio River basins (Hubbs et al 1991). Currently the Guadalupe bass is threatened by hybridization with non-native smallmouth bass *Micropterus dolomieu*; pure bred Guadalupe bass are increasingly harder to find in areas where smallmouth bass have become established (Garrett 1991). The spawning behavior of Guadalupe bass has not been as well

documented as have the other, more popular, bass species. Snorkeling and visual surveys were conducted during fall of 2012 between September and November at four sites with Guadalupe bass populations present. The South Llano River, Gorman Creek, Pedernales River, and the Guadalupe River were utilized as study sites for field surveys. Gorman Creek and the Pedernales River represent two pure strain populations of Guadalupe bass, while the South Llano River and Guadalupe River represent two populations with introgression from introduced smallmouth bass (Garrett 1991). Guadalupe bass may have a secondary spawn in the fall (Edwards 1980). During the fall sampling period no active Guadalupe bass nests were observed. Field work will be carried out during the spring of 2013 (March to May) to document courtship spawning and habitat characteristics through snorkeling and above water observations. An ethogram will be developed from behavioral observations made in the field. Through this field work reproductive characteristics and behaviors will be elucidated for which there is currently no published work.

Behavioral Differences of Large and Small Red Snapper (*Lutjanus campechanus*) in the Western Gulf of Mexico

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Red Snapper (*Lutjanus campechanus*) is arguably one of the most important recreational and commercial fish in the Gulf of Mexico, and is a focus for management efforts. There is little information available about the behavior of larger fish (>600mm) due to their lack of abundance in recent years. We tagged individuals with VEMCO V9AP accelerometers at an artificial reef (oil platform) off the coast of Port Aransas, TX. Fish were tracked for up to 55 days to determine behavioral differences in site fidelity, acceleration, and depth between large and small fish. We found that small fish exhibited higher site fidelity and were more likely to remain close to the reef, staying at the reef site for a longer total period. Large fish spent a higher proportion of time at lower acceleration rates than smaller fish, indicating that small fish are more active around the reef site. Depth varied among individuals, with fish moving within a daily range of 24.18 + 7.84 meters. Overall, small fish were located at variable depths within individual ranges throughout a 24-hour period. Large fish, however, varied in depth location for hours 0-12, remaining at a more continuous depth for the afternoon and evening (hours 13-20). The results of this study support that large red snapper individuals exhibit behavioral differences compared to smaller fish, indicated by differences in site fidelity, acceleration and depth location. These differences in behavior and life history strategies affect future management decisions for large vs. small fish.

Saltmarsh Pond Classification and Fish Community Dynamics at the Aransas National Wildlife Refuge

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In estuarine systems, inundation regime plays a vital role in shaping the physical and chemical characteristics of saltwater ponds. At the Aransas National Wildlife Refuge (ANWR), these saltwater ponds are scattered across the coastal marsh landscape, each possessing a varying degree of hydrological connectivity to marine water. Previous research in the region identified nekton usage of the greater marsh surface, while here we propose to determine fish presence and persistence in coastal saltwater ponds. In addition we will collect a wide range of physical and biogeochemical data to characterize the ponds in an attempt to determine how these environmental characteristics work to impact the composition of fish assemblages in ponds. These efforts will include verifying pond size and bathymetry, sediment and vegetation types and a wide range of pond water quality parameters (e.g., pH, dissolved oxygen and nutrient concentrations, etc.). Fish assemblages within the ponds will be collected through standard seining techniques with fishes being preserved and identified to the species level. Understanding the marsh pond dynamics at the ANWR, which is wintering grounds for the endangered whooping

crane (*Grus americana*), is an important step in comprehending both food web dynamics and overall coastal management practices in the system.

Combined Acoustic-Radio Tracking of Blue Sucker in the Lower Sabine River

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Blue sucker, *Cycleptus elongatus*, is listed by the State of Texas as a threatened species and recruitment concerns have arisen in a number of Texas river basins. This study will characterize seasonal movements and habitat use of the blue sucker in the lower Sabine River. The primary objectives are to determine spawning locations by locating sexually mature adults, track movements during different seasons, and determine differential habitat use among varying life stages. During October 2012, 56 blue suckers were tagged using combined acoustic-radio transmitters (N=45) and radio transmitters (N=11). Fishes were collected from River Mile 145 near Toledo Bend dam to River Mile 30 near Deweyville, Texas. Total lengths ranged from 266 to 620 mm and weights ranged from 120 to 2290 g. Of the 56 tagged suckers, 21 were males, 22 were females, and three were of undetermined sex. An array of eight submersible acoustic receivers was deployed in the lower Sabine River to monitor longitudinal movements. Monthly radio tracking (bi-monthly during spawning season) will provide location information. Once located, habitat data will be collected. Tracking results from November and December 2012 will be summarized along with information on fish collection, procedures used for implanting tags, and tracking approaches. Results from this study will be used to identify conservation strategies in large river systems containing long-lived flow-sensitive species such as the blue sucker.

Texas Marine Species Identification Website

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The Texas Marine Species Identification website is a web-based collection of photographs and information on marine species (fishes, invertebrates, plants and other vertebrates) found off the coast of Texas. The project began a few years ago to provide Texas Parks & Wildlife Coastal Fisheries technicians and biologists with simple visual aids in identifying organisms caught in routine sampling. It started as a collection of printed digital images that pointed out the distinguishing characteristics of each organism. Ultimately, the species list and content were expanded, and the images and data were made available on the World Wide Web. By expanding this information to the internet, it allowed not only biologists and technicians, but the general public, access to a usable, visual tool for identifying Texas' species. The website is photo-based using whole specimen and close-up photos of features useful in identification. Each species has information on distinguishing characteristics, similar species, maximum size, habitat, current and former common and scientific names, state bag and size limits, fin ray counts (fishes), and other pertinent info. There is a diagnostic key to fish families. There is also a feature key where you can query the list of fishes by particular features. The information is presented in an understandable way so that users of all backgrounds and levels of expertise may benefit from the knowledge. The website is expandable and is constantly updated as new species and photographs become available.

Population Assessment of the Alligator gar *Atractosteus spatula* in the Lower Brazos River, Texas

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Continued conservation and management of alligator gar in Texas requires information from all populations throughout the state. However, this data is currently lacking from many drainages, including the Brazos River. Alligator gar have seldom been observed or collected with standardized gears and techniques on the Brazos River, yet anecdotal information from anglers and bow fishers suggests an abundant population of alligator gar in the lower drainage. This mark/recapture study began in early 2012, primarily to estimate alligator gar population abundance and size structure within a 73-kilometer stretch of the Brazos River, between Waco and Marlin, Texas. Data collected from the study will also be used to better our knowledge of growth rates, gear selectivity, tag retention, genetics, and possibly improve insight on movement patterns and spawning site preference. Sampling in 2012 utilized multifilament gill nets measuring 61 m x 3 m x (89 mm, 102 mm, 114 mm, or 127 mm) mesh size. Jug line, rod and reel, and snaring rigs designed specifically for the project will also be employed during upcoming field seasons. To date, 51 alligator gar have been collected in 152 gill net hours, for a catch per unit of effort (CPUE) of 0.369 fish/hour. Five tagged individuals have been recaptured: four from gill nets, and one by a rod and reel angler who released the fish alive. Total length averaged 1730 mm, (range = 1004 mm to 2360 mm) and total girth averaged 749 mm. Captured individuals were typically concentrated near mouths of major tributaries during high flow events, few individuals were collected when river stage was dropping, and recaptured individuals had not traveled far from their initial tagging sites.

Acknowledgments

The contributions of the abstract authors and the Editorial Committee towards the preparation of these Proceedings are gratefully acknowledged.

The Texas Chapter is appreciative to the many contributors who donated goods, money, and services for auction and raffle during the 2013 meeting in Conroe, Texas.

CITATION:

Author(s). 2013. Title. Pages ____ *in* Daugherty, D. and A. Pease, editors. Annual Proceedings of the Texas Chapter, American Fisheries Society, Volume 35. Texas Chapter, American Fisheries Society, Austin, Texas.

ISSN 1060-2224