

ANNUAL PROCEEDINGS
of the
TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY



Kerrville, Texas
21-23 January 2016

Volume 38

TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY

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

MEMBERSHIP

Persons interested in the Texas Chapter and its objectives are eligible for membership and should apply to:

Texas Chapter, American Fisheries Society
Secretary-Treasurer
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744

Annual membership dues are \$12 for Active Members and \$5 for Student Members.

**ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER
AMERICAN FISHERIES SOCIETY**

Annual Meeting
21-23 January 2016
Kerrville, Texas

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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
2014	Richard Ott	Pottsboro
2015	Bruce Hysmith	Tyler
2016	Kevin Storey	Kerrville

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 - Kathryn 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 Higginbotham (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)
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 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)
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 Fisheries Management – John Moczygemba (TPWD)
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 Best Professional Presentation – Ray Drenner (TCU)
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 Best Student Poster Presentation – Brianne Kiester (TCU)
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- 2010 Fisheries Administration – Mike Ray (TPWD)
 Fisheries Research – Aaron Barkoh (TPWD)
 Fisheries Culture – Hugh Glenewinkel (TPWD)
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 Fisheries Management – Richard Ott (TPWD)
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 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 Ahmadi
 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 Kolodziejcyk
 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)
- 2014 Fisheries Administration – Dave Terre (TPWD)
 Fisheries Education – Reynaldo Patiño (TTU, USGS)

- Fisheries Culture – Possum Kingdom Fish Hatchery Team (TPWD)
 Fisheries Research – Warren Schlechte (TPWD)
 Fisheries Student – Tony Rodger (TAMU)
 Fisheries Management – Brad Littrell (BIO-WEST)
 Technical Support – Patsy Berry (TPWD)
 Special Recognition – Fishes of Texas Team (UT Texas Natural History Collections)
 Special Recognition – Gary Garrett (TPWD)
 Special Recognition – Todd Driscoll (TPWD)
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 Best Student Presentation – Kole Kubicek (TAMU)
 Best Professional Poster Presentation – Bryan Legare (TPWD)
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 Scholarships, Undergraduate – Takona Tipton (TAMU)
 Scholarships, Graduate (M.S.) – Jessica East (TTU)
 Scholarships, Graduate (Ph.D.) – Landes Randall (TAMU)
 Harry Tennyson Scholarship – Maelle Comic (TAMUG)
 Harry Tennyson Scholarship – Lisa Havel (UTMSI)
 Clark Hubbs Research Award – Jessica East (TTU)
- 2015 Fisheries Education – Dan Roelke (TAMU)
 Fisheries Culture – Deborah Wade (TPWD)
 Fisheries Research – Dan Daugherty (TPWD)
 Fisheries Research, Honorable Mention – Tim Grabowski (USGS, TTU)
 Fisheries Student – Jessica East (TTU)
 Fisheries Student, Honorable Mention – Erin Bertram (UTT)
 Fisheries Management – Marcos De Jesus (TPWD)
 Technical Support – Karim Aziz (TPWD)
 Special Recognition – Jimmie Green
 Special Recognition – John Taylor (TPWD)
 Special Recognition – Bass Brigade – Texas Brigade
 Best Professional Presentation – B.P. Fleming, Dan Daugherty, Nate Smith (TPWD)
 Best Student Presentation – D. Symonds (UTT)
 Best Professional Poster Presentation – Gene Wilde (TTU)
 Best Student Poster Presentation – Meriel LeSueur (TCU)
 Scholarships, Graduate (M.S.) – Matthew Acre (TTU)
 Scholarships, Graduate (M.S.) – Quentin Hall (TAMUCC)
 Scholarships, Graduate (M.S.) – Danielle Macedo (TAMU)
 Scholarships, Graduate (Ph.D.) – Jenny Oakley (TAMU)
 Harry Tennyson Scholarship – Erica Knowles (WTAMU)
 Harry Tennyson Scholarship – Kenneth Zachary (TAMU)
 Clark Hubbs Research Award – Aaron Urbanczyk (TTU)
- 2016 Fisheries Administration – Carl Kittel (TPWD)
 Fisheries Education – Frances Gelwick (TAMU)
 Fisheries Research – Tim Grabowski (USGS, TTU)
 Fisheries Research, Honorable Mention – Gerald Kurten (TPWD)
 Fisheries Student – Harlan Nichols (TXSTATE)
 Fisheries Student, Honorable Mention – Eric Tsakiris (TAMU)
 Fisheries Student, Honorable Mention – Greg Cummings (TPWD)
 Fisheries Student, Honorable Mention – Dave Ruppel (TXSTATE)
 Special Recognition – Greg Conley (TPWD)
 Special Recognition – Jennifer Pollack (TAMUCC)
 Special Recognition – Zoe Ann Stinchcomb (TPWD)
 Certificate of Appreciation – Michele Nations (TPWD)
 Best Student Presentation – Thomas TinHan (TAMUG)

Best Professional Presentation – Matthew Chumchal (TCU)
Best Student Poster Presentation – Amanda Pinion (TAMU)
Best Professional Poster Presentation – Matthew Chumchal (TCU)
Scholarships, Graduate (M.S.) – Kaylan Dance (TAMUG)
Scholarships, Graduate (M.S.) – Matthew Dzaugis (UT)
Scholarships, Graduate (M.S.) – Caroline Arantes (TAMU)
Scholarships, Graduate (Ph.D.) – Thomas TinHan (TAMUG)
Harry Tennyson Scholarship – Gunnar Nystrom (TCU)
Harry Tennyson Scholarship – Jeffrey Plumlee (TAMUG)
Clark Hubbs Research Award – Ryan Vazquez (TTU)

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
USGS – U.S. Geological Survey
UT – University of Texas – Austin
UTMSI – University of Texas Marine Science Institute
UTPA – University of Texas – Pan American
UTT – University of Texas – Tyler
WTAMU – West Texas A &M University

TECHNICAL SESSION ABSTRACTS

Strategies for securing water for the environment

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Kevin Mayes (*River Studies Program, Texas Parks and Wildlife Department, San Marcos, Texas 78667*)

Recent periods of drought have highlighted the need to better address environmental flow shortages throughout Texas. Extreme no flow conditions in the upper Brazos River led to rescue actions for two imperiled prairie cyprinids, low spring flows in Comal Springs triggered contingency actions for several species of concern, and a coast-wide red tide event threatened commercial and recreational fisheries. Future increased demands for water combined with shifting patterns of water use, changing hydrologic patterns, and a water rights permitting system that has not always recognized environmental water needs may increase the frequency, duration and extent of low flow conditions and further threaten fish and wildlife resources. Senate Bill 3 (2007) established a stakeholder process for determining environmental water needs and setting environmental flow standards. Recognizing a shortage of unappropriated water in parts of the state to meet the enacted environmental flow standards, stakeholder committees also identified strategies for securing water to meet the standards. Strategies included the voluntary sale, donation, or leasing of existing water rights; dedication of return flows; dam re-operation; dry year options on irrigation use; water conservation; and improved land use management. Although strategies were identified, they lacked plans for implementation and currently have no funding mechanisms in place. Texas Parks and Wildlife Department staff has identified a need for a Texas Environmental Flows Implementation Toolkit (EFIT) which can be used to develop and prioritize strategies for the restoration and preservation of natural flow regimes and water levels. Using a number of interdisciplinary metrics, EFIT will provide the spatial framework for querying diverse underlying data layers and enable scientists and water managers to prioritize stream segments and watersheds most amenable to specific strategies for restoring flows and water levels to the environment.

New approach predicts invasive potential of exotic species

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A questionnaire approach to aquatic invasive assessment developed for New Zealand has recently been adapted for use in the United States. The method is designed for use by natural resource professionals and is based on ordinal scoring of management and species natural history traits followed by summation of scores and delineation of species into high, medium, and low score groups. The score groups represent species deemed major, minor, and non-invasive species. Predictive success appeared high for this method, but validation procedures were not applied to test how well the method performs with unknowns. We demonstrate the basic method can be improved and made more intuitive using a multivariate analytic approach. The new method produced better classification success, and validated results indicated less grave misclassifications. The graphical presentation of the new approach is also superior as it is literally a vector map pointing out which questions in the survey are more or less vital to discriminating invasive classes. Thus, natural history-based assessments of invasive potential can be vastly improved at the analytical stage by reducing certain (particularly grave) classification errors and by providing a clear map to conceptual understanding.

Validation of environmental flow regimes in Brazos, Guadalupe, and San Antonio rivers

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Timothy H. Bonner (Texas State University, 601 University Drive, San Marcos, TX 78666)

Validation of recommended environmental flow regimes by quantifying biotic and abiotic responses is necessary for refining recommendations. Currently, most Texas rivers are managed under the theory of the Natural Flow Paradigm, the basis for the established environmental flow recommendations. The purpose of our study is to validate instream flow recommendations implemented on the Lower Brazos, Guadalupe, and San Antonio Rivers. Study objective is to investigate macroinvertebrate and fish assemblages and determine an ecological response to instream flow recommendations (e.g., subsistence, base, 1 per season, 1 per year). Fourteen sites associated with USGS gaging stations were visited over a period of twelve months with visits classified into flow tiers based on the preceding fifteen days. Riffle and run habitats were sampled for swift water specialists and diet (gut fullness) and condition factor (HSI) was investigated. Over 50 hypotheses were tested among basin, season and flow tier. Relative abundance of slackwater fish and occurrence of fluvial fish differed among flow tiers, whereas relative abundance of fluvial fishes differed in run habitats among flow tiers. This insight will be used to understand ecological responses to the current implemented flow recommendations to maintain a sound ecological environment.

Effects of pH and salinity on juvenile hatchery reared Red Drum (*Sciaenops ocellatus*)

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Robert Vega

Joe Fox

Anthony Siccardi

David Portnoy

A regional concern regarding climate change and ocean acidification (OA) is its potential impact on Texas ecosystems and estuarine-dependent fishes. It is well documented that fish growth, development, and survival are dependent on environmental factors such as temperature and salinity. With the economic and recreational importance of red drum (*Sciaenops ocellatus*) it is vital to understand the effects of the environment on juveniles so that stock enhancement hatcheries can produce the best quality fish. The current research trials were designed to compare growth and body composition of juvenile red drum grown under different salinities and pH. Trials were conducted in four eight-tank indoor closed recirculating systems (~662 liters total volume per system) with a light:dark photoperiod of 12:12. Seawater for each separate system was recirculated at 227 liters per hour (7,923% exchange per day) through a mechanical filter (200 μ m) and a biological filter prior to returning to the tanks. Juvenile red drum (35-51mm) previously conditioned to a commercial fish diet (Rangen size 1) were randomly stocked at a density of 13 fish/tank and fed daily to satiation (~6% body weight). Fish were subjected to a constant salinity of 40, 30, or 20 (ppt) and a pH of 7.5, 8.1, 8.5, or 9.0 (3 \times 4 factorial design). Each trial was conducted for 14 days. Results showed no significant effect of pH on spontaneous growth rate ($p > 0.05$); however, growth rate decreased with increased salinity ($p < 0.05$). There was also a significant ($p < 0.05$) interaction between pH and salinity. Growth rate decreased significantly at 40 ppt. Results of this study indicate that juvenile red drum are quite tolerant of pH conditions in bays and estuaries, but require lower salinities for normal growth. Result of treatments on body composition (whole –body ash, protein retention, and gross energy) also will be presented.

Effectiveness of a non-lethal method to quantify gamete production in freshwater mussels

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Kevin W. Conway (*Department of Wildlife and Fisheries Sciences and Biodiversity Research and Teaching Collections, Texas A&M University, College Station, TX*)

Studies on the reproductive biology of freshwater mussels have been essential towards the conservation of endangered mussel species. Although, paradoxically, methods to study mussel reproduction rely extensively on the lethal preservation of specimens for laboratory dissection (e.g., histological analysis). We validated the usefulness of a non-lethal technique for quantifying gamete production, which involves the use of a syringe needle to extract gonadal fluid from mussels. Using four mussel species, including two common species (*Quadrula apiculata*, southern mapleleaf and *Quadrula verrucosa*, pistolgrip) and two state-threatened species (*Quadrula houstonensis*, smooth pimpleback and *Quadrula petrina*, Texas pimpleback), we specifically tested (1) if gamete production measured with the syringe technique was correlated to gamete production measured histologically, and (2) if survival, growth and body condition of mussels were affected by this technique in a two-year mark-recapture experiment. Gamete production measured over the first year of the experiment indicated sperm concentration and egg size measured with the syringe technique were positively correlated with sperm density and egg size measured histologically, while egg concentration was significantly correlated in only some cases. Joint analysis of live and dead encounters indicated the syringe technique had little to no effect on survival probability, and mixed models of mussel growth and Fulton's K body condition index indicated the syringe technique did not affect mussels sub-lethally. Our results suggest the syringe technique, being both relatively accurate and noninvasive, can be used to study the reproductive biology of endangered mussels quantitatively, and can provide large sample sizes often needed in ecological studies.

Movements and habitat use of the Blue Sucker *Cycleptus elongatus* using radio and acoustic telemetry in the lower Colorado River, TX

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Dakus Geeslin (*Texas Parks and Wildlife Department, Coastal Fisheries Division, 4200 Smith School Road, Austin, TX 78744; 512-389-4800; Dakus.Geeslin@tpwd.texas.gov*)

Riverine systems have been heavily modified, particularly by dams and reservoirs, which alter the flow regime of the river, e.g., the timing, duration, flashiness, and magnitude of discharge. Alterations to the natural flow regimes can lead to population declines and potentially extirpation for riverine species with flow-related behavioral and life-history adaptations, such as using flood pulses to synchronize spawning and migration. Blue Sucker *Cycleptus elongatus* is a state-listed threatened species in Texas and considered vulnerable throughout its range due to a combination of its habitat requirements and life history traits, such as being long-lived and late-maturing, rendering it sensitive to flow regime alteration and habitat fragmentation. It has been hypothesized that Blue Sucker migratory behavior, spawning habitat quality requirements, and early life history stages render it sensitive to flow alterations. The primary objective of this research is to assess the effects of varied streamflow levels, regulated by water releases from upstream reservoirs, on habitat use of Blue Sucker in the lower Colorado River downstream of Austin, Texas. Radio telemetry techniques are used to assess response of Blue Suckers to river discharge by monitoring movement in the river. Combined acoustic-radio transmitter tags were surgically implanted into 43 adult and juvenile Blue Suckers. Habitat preferences and movement patterns are monitored and recorded during monthly active tracking events. Similarly, passive monitoring is used to assess coarser-scale movements throughout the river using 10 submersible ultrasonic receivers. Approximately 60-85% of the tagged fish are found during any given tracking event with some individuals making 200km migrations after flooding events. This work will provide critical information regarding conservation and protection of Blue Sucker in Texas. Results from this project will inform water management policy decisions affecting the lower Colorado River with implications to instream flows and freshwater inflows to coastal bays and estuaries.

Fish metacommunity dynamics in experimental streams are determined by species specific responses to habitat heterogeneity, drought-induced fragmentation and reconnectedness

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Drought disturbances can have strong but variable effects on aquatic communities and little is understood about the impacts of drought, fragmentation, and habitat re-connectedness on the dynamics of intermittent stream fish metacommunities. We performed two experiments using outdoor stream mesocosms to test the effects of drought-mediated connectivity and habitat heterogeneity on realistic stream fish assemblages at local (pool/patch) and regional (stream unit) scales under non-drought versus drought conditions (Exp. 1) and under drought conditions with ‘pulse’ flow connectivity versus ‘non-pulse’ (Exp. 2). Survivorship, α -diversity, and γ -diversity differed little at the unit level between treatments and experiments, but significant interactions between treatments and pool position were observed for species richness and abundances at the pool-level. Specifically, drought (Exp1) and non-pulse (Exp2) treatments had consistently higher species richness and abundances in deeper downstream pools because of downstream-biased immigration during the onset of drought and higher residency among fishes in downstream pools. Species-specific responses in these treatments resulted in downstream pools that were characterized by species pre-adapted to lentic conditions (e.g. sunfishes), whereas upstream pools were characterized by smaller bodied top-water and water column species. Non-drought (Exp1) and pulse (Exp2) treatments showed no difference in richness or abundances among pool positions and assemblages were generally well-mixed, indicating that connectivity (even a brief re-connecting pulse) of pool refugia was important for determining local and regional assemblage structure and mediating the impacts of drought. These experiments demonstrate that stream fish assemblages responded strongly to reduced flows and fragmentation and that metacommunity dynamics were structured by differential emigration and immigration rates and directionality among heterogeneous and variably connected pool habitats.

Feeding ecology of coastal sharks in the northwest Gulf of Mexico

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The feeding ecology of three coastal shark species consisting of Atlantic Sharpnose (*Rhizoprionodon terraenovae*), Bonnethead (*Sphyrna tiburo*), and Atlantic Blacktip (*Carcharhinus limbatus*) was examined in the northwest Gulf of Mexico (GOM). A total of 601 (305 *R. terraenovae*, 239 *S. tiburo*, and 57 *C. limbatus*) sharks were collected over two years and had stomach contents examined for all individuals along with stable isotopes (carbon, nitrogen, and sulfur) in muscle tissue analyzed for a subset ($n = 136$) of samples to reveal short-term and long-term feeding strategies, respectively. Both *C. limbatus* and *R. terraenovae* stomach contents primarily consisted of teleost fish with % index of relative importance (IRIs) of 98.95% for *C. limbatus* and 91.16% for *R. terraenovae*, and *S. tiburo* had a diet primarily of crustaceans (IRI 87.20%). Stable isotope results revealed similar trends as the stomach contents. *S. tiburo* was shown to have higher mean carbon ($\delta^{13}C$) and depleted sulfur ($\delta^{34}S$) values, indicating inshore feeding as well as a preference for benthic invertebrates. *R. terraenovae* and *C. limbatus* were shown to feed on similar prey, yet *R. terraenovae* had a broader diet including cephalopods and crustaceans in addition to teleost fishes. Differences were further established between the two using nitrogen ($\delta^{15}N$) values, which were significantly lower for *R. terraenovae* than *C. limbatus*. Collectively, both stomach contents and stable isotopes support unique feeding strategies of three common shark species despite range overlap and sulfur appears to serve as a useful tracer to distinguish between benthic versus pelagic feeding patterns in elasmobranchs. This study provides important, ecosystem-based feeding information of upper-level predators in coastal waters of the northwestern GOM.

Influence of drought and anthropogenic flow alterations on the growth of stream fishes on the Edwards Plateau, central Texas

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Drought and flow regime alteration have the potential to affect fish growth through numerous mechanisms and in so doing, can greatly influence demographic processes, such as recruitment and mortality. Changing climate patterns and increasing water demands from a rapidly growing human population has made understanding these effects critical to the conservation and management of stream fishes on the Edwards Plateau in central Texas. Our objective was to evaluate the influence of annual flow regime on the growth rates of a suite of stream fishes within a paired river system in central Texas. The North Llano River (NLR) and South Llano River (SLR) are adjacent low-order, spring-fed streams of similar size that differ greatly in their flow regimes due to differences in spring inflows and anthropogenic water withdrawals. The NLR and SLR provide a natural experiment to evaluate the influence of annual flow regime on growth in systems experiencing the same climatic conditions, such as the recent drought, but differing in their degree of flow alteration. We collected otoliths from eleven stream fish species common to both the NLR and the SLR and back-calculated lengths at age. We used mixed-effect models to evaluate the influence of annual flow regime on growth. We will present the results evaluating the effects of drought and altered flow regime on the growth of eleven species. Our results indicated that species response to annual flow regime, particularly drought conditions, was species specific and varied between the two river systems. Our results will provide a better understanding of how drought coupled with anthropogenic alterations affect the overall growth rate of stream fishes and will help improve decisions made for the management and conservation of stream fishes, particularly those related to water management and instream flows.

Impacts of urbanization on spring fish communities

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Water quality and quantity within the upper San Antonio River (Bexar County, Texas) were supported historically from spring discharges of the Edwards Aquifer. Since the 1700s, water quality and quantity alterations along with other habitat degradation (e.g., stream channel alterations) are associated with changes in the upper San Antonio River fish community. Efforts are underway to rehabilitate a section (i.e., Mission Reach) of the upper San Antonio River. Purposes of this study were to quantify changes in the upper San Antonio River fish community by comparing past collections to contemporary collections and to develop rehabilitation goals for the existing fish community. We found that upper San Antonio fish community has changed through time, specifically decreases in spring-associated fish richness and abundances and increases in non-native taxa, though changes were determined based upon reference streams and not historical records within the upper San Antonio River due to limited historical collections. We also found that the rehabilitated Mission Reach supported the greatest number of native fishes (91% of the fish community) and the only riffle-specialist species but overall differences between the rehabilitated and non-rehabilitated reaches, to date, were minor. We propose that future rehabilitation efforts should set goals related native fish richness and diversity and not specifically for spring-associated fish richness and diversity, since restoring spring flow, a major determinant of spring fish communities, is not part of the rehabilitation effort.

Development of methodology to validate freshwater needs of the Brazos River estuary

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The State of Texas is currently in the process of validating environmental flow recommendations in an effort to maintain sound ecological environments in rivers and estuaries. It is assumed that one of the primary mechanisms regulating production in estuaries is the discharge of freshwater which provides sediment and nutrients and creates an optimal salinity gradient influenced by freshwater inflow and tidal forces. The primary purpose of this study was to develop methodology to validate instream flow recommendations for the Brazos River estuary based on the nearest USGS gage in Rosharon. The objectives of this study were to 1) characterize the flow regime, 2) develop a lag-time estimate to compare riverine flows at the Rosharon gage to real-time conditions in the estuary and 3) describe how responses in water quality and species composition can be used to validate instream flow recommendations. Continuous and opportunistic water quality and biological samples were collected from November 2014 to August 2015. Ten water quality sampling events (9 included nekton) were distributed across the hydrograph ranging from dry base flow conditions to 1/season high flow pulse (HFP) events. Water level peak in the estuary occurred within 5-10 hours of a peak HFP at the Rosharon gage depending on the magnitude and timing of the pulse. Physical hydrologic patterns (water height) in the estuary are tidally driven below and flow driven above 6,850 cfs (2/season HFP) in the spring and 6,340 cfs (1/season HFP) in the summer. High flow pulses of 2/season and greater significantly increased nutrient concentrations as well as altered nekton community composition within the estuary. Continued monitoring of water quality and flow along with the integration of biological community data will help resource managers better understand the influence of freshwater inflow on biota and plan for the freshwater needs of the Brazos River estuary.

Determining factors affecting Dermo Disease (*Perkinsus marinus*) in populations of Eastern Oysters (*Crassostrea virginica*) in Galveston Bay, Texas

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Roel Lopez

The Gulf Coast has seen a decline in commercial oyster harvest in recent years. Lack of fresh-water inflow and elevated temperatures and salinities have been identified as factors contributing to increased Dermo disease of oysters, caused by the parasite *Perkinsus marinus*, which attacks their tissue and is responsible for individual oyster and oyster reef kills along the Gulf Coast. A disease has its largest detrimental effect on a host when environmental conditions support an abrupt increase in density of the pathogen population. Therefore, documenting the relationships between distribution and prevalence of Dermo disease in the eastern oyster (*Crassostrea virginica*) and environmental conditions would be beneficial to management of the eastern oyster in Galveston Bay. My study consisted of four sites located in Galveston Bay, Texas, which were sampled 20 oysters every other month from November 2014 through September 2015. Specific objectives were to determine: (1) prevalence of Dermo in oysters, (2) spatial location of Dermo infected oysters, (3) concentrations of the parasite Dermo within infected oysters (Mackin Dermo Intensity Scale), and (4) the relationship of water quality parameters (i.e., fresh-water flow, salinity, water temperature, and water turbidity) to prevalence and parasite concentration of Dermo disease in oysters. Initially (November 2014), Dermo was present in oysters at all reefs sampled, and Dermo prevalence was greatest at April Fool (0.55, intensity on Mackin Dermo Intensity Scale) and Confederate (0.85) reefs, but declined after heavy rainfall (July 2015, April Fool Reef: 0.21, Confederate Reef: 0.81). Linear regression analysis indicated water variables such as temperature, salinity, turbidity and fresh water inflow explained different amounts of the variability in the Mackin Dermo Intensity Scale among sampled reefs.

Fresh-water inflow from the Trinity River explained the most variability in Dermo intensity at April Fool (61.8%), Fishers (44.5%), and Frenchy's (46.9%) reefs. At Confederate Reef, salinity (20.6%) explained the most variability in Dermo intensity, and this reef was least affected by the Trinity River flow. I found that combinations of low fresh-water inflow, high salinity, and high temperatures accounted for majority the variance of Dermo in oysters located in Galveston Bay. However, this relationship was not necessarily a linear relationship with mortality, in that high fresh-water inflow also was related to oyster mortality at Fishers Reef.

Conducting surveys of recreational anglers: strategies for minimizing sampling error

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Effective management of recreational fisheries necessitates in-depth knowledge of angler attitude and behavior. However, data concerning the characteristics, preferences and behaviors of recreational anglers, which enable managers to gauge the efficacy of management decisions and policy, are only recently – relative to ecological data – being included in decisions for recreational fisheries management. In order to better understand the diversity of recreational anglers, agencies often utilize survey methods to collect data on angler characteristics and preferences. However, obtaining representative data from the diversity of the angling population is becoming increasingly challenging owing to the public's apparent antipathy to public appeals for their input. In this investigation, we explored the effectiveness of different survey designs along with their biases. Specifically, we examined three survey designs, with varying modes of solicitation and response, in the context of licensed Texas anglers: 1) mail with a web push, 2) email, and 3) simultaneous mail and email (mixed mode). Our findings illustrate that response rates varied considerably among these three survey designs. We also observed significant variation among angler characteristics and preferences in terms of income, gender, avidity, and motivations. These findings suggest that a survey's mode of solicitation and response can significantly affect response rate. Additionally, the chosen mode of solicitation and/or response can influence which anglers respond, and, consequently, introduce significant variability into a sample. To accurately collect data on resource users' characteristics and preferences, both researchers and managers must be aware of the variability a particular survey design can introduce into data collection efforts.

Feeding ecology of two model predators at artificial reefs in the northwestern Gulf of Mexico

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Two heavily exploited species in the Gulf of Mexico (GOM), Red Snapper *Lutjanus campechanus* and Gray Triggerfish *Balistes caprisacus*, were used as model species to contrast the feeding ecology of demersal and midwater predators at nearshore (16-60 km offshore) artificial reefs (ARs). Red Snapper (demersal, n=115) and Gray Triggerfish (midwater, n=51) were collected via vertical longline and trap surveys across six AR sites (comprised of various reef types) ranging from 13 –31 meters in depth from August- November of 2014. Epaxial muscle tissue was used to obtain species-specific isotope ratios, and stomach contents were identified to the lowest possible taxon. Stable isotope ratios of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and sulfur ($\delta^{34}S$) paired with stomach

content analyses were used to compare the feeding ecology of model species, and also to examine ontogenetic dietary shifts of Red Snapper across different reef types. Red Snapper stable isotope values for carbon ($\bar{x} = -17.70$) and nitrogen ($\bar{x} = 14.60$) were enriched relative to Gray Triggerfish, while sulfur ($\bar{x} = 18.76$) was more depleted. Results of this study will impart valuable insight on the functional role of ARs to these model species, and will be discussed in terms of species life history and fisheries productivity.

The spatial scale of similarity and patterns of homogenization and differentiation in Chihuahuan Desert riverine fish assemblages

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Desert aquatic ecosystems around the world are declining in water quantity, quality and native species diversity. Fish assemblages in these ecosystems are increasingly becoming homogenized, although the degree of homogenization is dependent on the magnitude and direction of change following extirpation and colonization events and the spatial scale of observation. The frequency of species loss and gain, the identity of those species, and the regional extent of these changes interact with historical patterns of species diversity and environmental change, and determine resulting patterns. We examined the spatial scale of similarity for fish assemblages in the highly modified Rio Grande basin in the Chihuahuan desert of West Texas using a well-documented historical data set and recent collections that provided a paired analytical design across 29 localities spanning approximately 30 years of time. Results indicated that homogenization and differentiation occurred, but these patterns depended on the spatial resolution of comparison. The greatest changes were found for between stream reach comparisons within a sub-basin. The Rio Grande sub-basin showed strong convergence between upstream and downstream reaches that corresponded to declining water quality and quantity from the Rio Conchos in Mexico. The Pecos River sub-basin showed strong differentiation between upstream and downstream reaches. Assemblage similarities within specific river reaches of each sub-basin were variable in their degree of historical change, which was largely dependent on anthropogenic modification to the flow regime change and variability in the success of invasive species.

Known knowns, known unknowns, and unknown unknowns: a case study evaluating the conservation status of *Popenaias popeii* in the Rio Grande and Devils River, Texas

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Texas hornshell (*Popenaias popeii*) is one of 52 freshwater mussel species found in the state of Texas and is endemic to the Rio Grande basin in the U.S. (Howells et al 1996). Due to the remoteness of this river system and historical lack of interest in freshwater mussels by regulatory agencies in Texas, the Rio Grande and tributaries had not been extensively surveyed until recently. Within the last 15 years, more freshwater mussel data were collected there than any time in the past, however, the methods used to obtain those data vary. Karatayev and others (2015) concluded that Texas hornshell has been extirpated from Las Moras Creek and the Pecos River, and the total population in Texas has been reduced by 72% from historical levels based on their 2001-2013 survey data

and published records from 1893 to present. Here we present new data that highlight sampling biases and methodological differences that have major implications for the conservation status of this and other species of freshwater mussels in this desert river system.

Review of the Texas list of Species of Greatest Conservation Need

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The Fishes of Texas team is working with Texas Parks and Wildlife Department to review and update the Texas list of Species of Greatest Conservation Need. We first looked at changes in distribution over recent decades and then summarized current status by soliciting input from researchers across the state. Based on these discussions, we propose retaining 58 of the current species, removing three species from the list and adding an additional 16. Most of the additions are due to newly recognized species, but some are the result of declining range and status. There are still 11 species that have not been resolved and deliberations with TPWD staff and others are ongoing. Details of the proposed changes as well as the unresolved species will be discussed.

Habitat utilization of juvenile Atlantic Croaker in coastal Texas estuaries determined with otolith chemistry and stable isotopes

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Understanding the true value of estuarine nurseries requires information on habitat connectivity and trophic interactions. A novel multi-proxy natural tag approach was developed to estimate estuarine immigration and habitat utilization of juvenile Atlantic croaker in subtropical estuaries of the western Gulf of Mexico. Juvenile age-0 croaker were collected from estuaries along a latitudinal gradient that included Galveston Bay (GB), Mission-Aransas (MA), and the hypersaline Laguna Madre (LM) to test the hypothesis that estuarine ingress timing and habitat residence would vary along climatic and physicochemical gradients. Otolith elemental chronologies of Sr:Ca and Ba:Ca were used to detect fish movement across salinity gradients, while tissue-specific stable nitrogen and carbon isotope ratios revealed time since very recent (liver) and moderately recent (muscle) diet shifts. Nitrogen isotope values in both liver and muscle tissues in fish from all sampling sites were highly correlated ($r^2=0.98$), suggesting both tissues were in isotopic equilibrium and fish were estuarine residents for at least 3 months prior to capture. Anthropogenic nutrient enrichment was reflected in increased $\delta^{15}N$ values in fish in Galveston Bay that receive high freshwater input. Deviations from the equilibrated muscle-liver $\delta^{13}C$ relationship (residuals) in both the GB and LM indicated recent diet shifts and fish movement between adjacent bays, suggesting connectivity between minor bays. Seagrass carbon isotope signatures were prevalent in the LM and MA, indicating the importance of this habitat to croaker production. Strong regional gradients in natural tag signatures suggest local adaptation to environmental conditions and supports bay-specific spatial management of estuarine dependent species along the Texas coast.

Fragmented coves as nursery habitats in an aging reservoir across years with contrasting hydrological conditions

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Lake Texoma is home to several isolated coves walled off by sedimentation as a result of reservoir aging. The habitat fragments are relatively new features on the landscape, isolated from the reservoir and taking diverse forms. These fragments have been formed on the arms of two physicochemically distinct rivers entering Lake Texoma (Red and Washita). Fragmented coves are located within the river-reservoir interface, a highly productive and ecologically important transitional zone. We examined the structure of young-of-the-year (YOY) fish assemblages utilizing these habitats and investigated the influence of environmental factors on taxonomic and guild composition. Sampling was carried out from March through August in 2014 and 2015 using light traps and push nets to target larvae and juveniles. Differences in YOY fish abundance and assemblage structure were observed between river arms and individual fragments. Analyses using NMS and ANOSIM revealed significant differences in the structure of larval assemblages between years, and diversity was higher in the very wet, flooded 2015 season. While habitat generalists were dominant throughout our study area, some fragments hosted species that rely upon river floodplain habitats for reproduction, especially during the year with more extensive hydrological connectivity. This work should provide managers with insights into the role that these novel habitats play in supplementing reservoir fish assemblages.

Predicting mercury contamination in game fish in the south central U.S.: interactions between mercury deposition, fish trophic position and fish size

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Mercury (Hg) is a toxic metal that is found in game fish and is hazardous to human health. The primary pathway of Hg to humans is the consumption of Hg-contaminated fish. Because fish from most water bodies in the U.S. are not monitored for Hg contamination, it is critical that we develop the ability to predict high concentrations of Hg in different species and sizes of fish in different regions. The objective of this study was to determine how atmospheric Hg deposition, fish trophic position and fish size interact to determine Hg concentrations in game fish in all or part of six states of the South Central U.S. In this study, we examined the relationship between average Hg concentrations in five size categories (stock, quality, preferred, memorable, trophy) of a low trophic position fish, bluegill (*Lepomis macrochirus*) (BG), and a high trophic position fish, largemouth bass (*Micropterus salmoides*) (LMB), and average Hg deposition in 14 ecoregions. We used the National Descriptive Model of Mercury in Fish to estimate the Hg concentrations in BG and LMB at 836 lentic and lotic sites. We used data from the Mercury Deposition Network to estimate wet atmospheric Hg deposition after adjusting for the presence of coniferous forests. As recommended by USEPA, we considered an Hg concentration in fish > 300 ng Hg/g to pose a health hazard to humans. Only memorable- and trophy-sized BG in ecoregions with high Hg deposition had hazardous levels of Hg. Preferred-, memorable- and trophy-sized LMB had hazardous Hg levels in all 14 ecoregions, with Hg in trophy-sized LMB in high Hg deposition ecoregions being four times greater than considered safe for human consumption. Our study suggests that game fish with the most hazardous levels of Hg will be high trophic-position and large-sized fish in ecoregions with high Hg deposition.

Disparity between state fish consumption advisory systems for methyl mercury and U.S. Environmental Protection Agency recommendations: a case study of the south central U.S.

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Fish consumption advisories are used to inform citizens in the U.S. about non-commercial game fish with hazardous levels of methyl mercury (MeHg). The U.S. Environmental Protection Agency (USEPA) suggests issuing a fish consumption advisory when concentrations of MeHg in fish exceed a human health screening value of 300 ng/g. However, states have authority to develop their own systems for issuing fish consumption advisories for MeHg. Five states in the south central U.S. (Arkansas, Louisiana, Mississippi, Oklahoma and Texas) issue advisories for the general human population when concentrations of MeHg exceed 700-1000 ng/g. The objective of the present study was to estimate the increase in fish consumption advisories that would occur if these states followed USEPA recommendations. We used the National Descriptive Model of Mercury in Fish to estimate the mercury concentrations in five size categories of largemouth bass equivalent fish at 766 lentic and lotic sites within the five states. We found that states in this region have not issued site-specific fish consumption advisories for most of the water bodies that would have them if USEPA recommendations were followed. One outcome of our study may be to stimulate discussion between scientists and policy makers at the federal and state levels about appropriate screening values to protect the public from the health hazards of consuming MeHg-contaminated game fish.

Influence of dispersal on ecological niche assessments for a reintroduced endangered teleost in a desert river

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The intentional reintroduction of animals to the wild is an important conservation tool for restoring extirpated species to their former ranges. Studies of species-habitat links at reintroduction sites can help identify the ecological requirements of extirpated species and assist reintroduction programs. Dispersal following reintroduction can greatly influence the ultimate distribution and abundance of a reintroduced species, however, and complicate the interpretation of results from such studies. This study examined the association of reintroduced *Hybognathus amarus* distribution and abundance with measured environmental variables, including dispersal (distance and time from reintroduction), in the Big Bend region of the Rio Grande, Texas, USA. Yearly reintroductions of this formerly extirpated species in the region began in 2008 and continued through 2012. All releases occurred in the river's mainstem. Mainstem and tributary samples for this study were collected in 2009-2011. Principal components analysis with *H. amarus* presence/absence as grouping factor was used to explore data patterns at three spatial scales: all sites, mainstem sites, and tributary sites. Zero-inflated Poisson regression analysis was used to examine relationships between the presence and abundance of *H. amarus* and environmental variables selected according to results of principal components analysis. Our results indicated that post-release dispersal largely accounted for the distribution and abundance of *H. amarus* when all sites were considered. Gravel (positive association), salinity (positive), and mean depth (negative) were associated with abundance in the mainstem. Salinity (negative) and muddy substrate (positive) were associated with abundance in tributary sites. In conclusion, effects of post-release dispersal and habitat conditions on the presence and abundance of *H. amarus*

varied across spatial scales, suggesting the importance of spatial scaling for a niche assessment of reintroduced species.

American Eel in Texas – what we do, don't and need to, know

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American Eel is undoubtedly one of the most studied freshwater fishes of North America. Many recent discoveries have added new insights that re-write important aspects of the “text book” knowledge of the species’ complex life history in ways that could have significant impacts on management. Despite all of this new information, debate about the species’ conservation status continues, and new threats, such as continued habitat loss and major clandestine fisheries driven by extremely high value in the global market, have further complicated management. Though USFWS recently decided that the species does not merit listing as “Endangered,” in 2012 Canada changed that country’s assessment of the species’ status from “Special Concern” (since 2006) to “Threatened” and IUCN upped its classification in 2013 to “Endangered.” Ontario has considered it “Endangered” since 2007. All U.S. Atlantic states vowed to work together to produce, in 1999, the American Eel Benchmark Stock Assessment, which mandated each state conduct standardized monitoring of recruitment and later, mandatory catch and effort monitoring. Given all that activity and data generation, it is remarkable that still so little is known about the populations of the Gulf of Mexico (GOM) and its tributary rivers that making any management decisions in that large, neglected part of the species’ range is virtually impossible. The Fishes of Texas Project team has been collating and improving the limited and scattered data on occurrences of the species in the region and concludes it important to promote a broad scale (Gulf of Mexico) collaborative community effort to acquire and share data and carefully curated specimens and, hopefully, develop a GOM-wide collaborative research and management plan like that implemented by Atlantic states. Here we’ll review the literature and state of knowledge about the species in Texas and GOM, and suggest ways to begin work toward such an effort.

Movement patterns and habitat associations of Guadalupe Bass in the lower Colorado River

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Guadalupe Bass *Micropterus treculii* are endemic to Texas and can be found throughout the Colorado River Basin. Guadalupe Bass are commonly associated with smaller tributaries but a thriving Guadalupe Bass fishery can also be found on the mainstem lower Colorado River. The Highland Lakes separate the smaller upstream tributaries from the mainstem lower Colorado River. The gradient of disturbance across the Colorado River Basin imposes differing pressures on Guadalupe Bass populations. Documenting movement and differences in habitat association between tributary and mainstem sites will facilitate the assessment of a variety of

anthropogenic influences on populations. The objective of our study is to determine if the habitat associations and occupancy patterns of Guadalupe Bass in the lower Colorado River downstream of Austin are similar to those described for counterparts in smaller tributaries upstream. In December 2014 twenty-four Guadalupe Bass were collected and surgically implanted with radio transmitters. Individuals will be tracked for the length of the tags' battery life and associated with recorded habitat data. Preliminary data show large movements occurring following high flow events in March and June 2014. Overall, Guadalupe Bass in the lower Colorado River are moving greater distances than previously described for individuals tagged in tributaries of the upper Colorado River. Ongoing research on movement patterns and habitat associations will allow for assessment of how Guadalupe Bass in the lower Colorado River differ from those in upstream tributaries.

The importance of groundwater flows to surface water in maintaining aquatic habitat

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The construction of reservoirs has, for many streams, altered the natural flow regime and affected aquatic habitat, water quality, and biota. Less well understood, however, is the role groundwater contributions to streams plays in maintaining instream habitat. A notable example is Comal and San Marcos springs, which flow from the Edwards Aquifer in Texas and maintain habitat for endemic aquatic species. Reduced spring flow from these systems has been correlated with groundwater pumping in the Edwards Aquifer. Many Texas streams flow over and exchange water with aquifers. However, Texas surface water and groundwater are managed under separate legal frameworks—and few aquifers are as well-studied as the Edwards. Thus, managing groundwater pumping to maintain aquatic habitat in streams with groundwater-surface water interactions is challenging. Nevertheless, conserving aquatic habitat necessitates that we develop science to improve our understanding of how groundwater use can affect surface flows, aquatic habitat, and Texas' fish and wildlife resources. Thus, the objectives of this talk are: (1) Present three general types of aquifers in Texas, including carbonate-rock, sand and gravel, and alluvial aquifers; (2) Discuss typical groundwater-surface water interactions such as discrete discharges (e.g. Comal and San Marcos springs), diffuse groundwater inflows across multiple locations (e.g. Guadalupe and Colorado rivers), and implications for habitat maintenance for each of these types of interactions; and (3) Illustrate concepts using case examples, including ongoing research by The University of Texas at Austin on the Devils River, which has a suite of species at risk of dewatering from possible future groundwater development projects (e.g., *Dionda diaboli*, etc.). We will present recent research on Central Texas streams, where freshwater mussels in Colorado River tributaries may be supported by groundwater inflows, compared to Brazos River tributaries where the Edwards-Trinity aquifer is thinner. We will also discuss the Upper Brazos River basin, where reservoir operation affects alluvial aquifer recharge and discharge processes and groundwater pumping of the Ogallala and Seymour aquifers influences flows to streams which support the Sharpnose Shiner and Smalleye Shiner, two prairie cyprinids recently listed as endangered. Ultimately, maintaining aquatic habitat for species of conservation need means that we need to understand the entire hydrologic system, including groundwater and the surface water it supports.

Influence of protected areas on fish assemblages and fisheries in a large tropical river

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Matias Silvano

Protected areas (PAs) are one of the main tools for biological conservation worldwide. Although PAs have contributed to an increase in fish abundance and alleviate fishing impacts in marine ecosystems, impacts from fishing and the effects of PAs are far less documented in freshwater ecosystems. PAs of sustainable use aim to maintain traditional livelihoods of local people, by promoting sustainable use of natural resources. We compare the fishing productivity and fish assemblage descriptors between two distinct PAs of sustainable use and an unprotected area in the Tapajós River, Brazilian Amazon. Two hypotheses were tested: 1) fishermen from PAs

have higher fish productivity (measured as catch per unit effort, CPUE) than those from unprotected areas; 2) PAs have higher biomass, abundance, presence of target species, species richness, fish size and mean trophic level (fish assemblages descriptors) than those from unprotected areas. A total of 2,013 fish landings were recorded in eleven riverine communities. Besides, two surveys were undertaken in four floodplain lakes of each area to sample fish. Eleven environmental parameters, related to physical-chemical parameters of water and lake structure and morphology, were quantified to distinguish between the influences of environmental heterogeneity and fishing pressure. The CPUE of fishers inside PAs was higher than in unprotected area, suggesting that PAs reduce the levels of fishing and increase fishing productivity. However, the fish descriptors were more related with environmental variables than with PAs, indicating a relatively weak effect of conserved areas over fish in lakes. These results highlight the importance of considering the influence of environmental heterogeneity on management programs aimed toward fish conservation and the positive effect of PAs to improve fishing productivity in freshwaters.

Influence of freshwater inflow on nekton of the Brazos River estuary

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The State of Texas is in the process of conducting validation studies to determine whether existing environmental flow standards adopted and implemented under the Senate Bill 3 process should be further modified. Many of these flow standards were initially adopted using limited data and best available science. The existing freshwater inflow standards for the Brazos River estuary utilize default instream flow standards for the closest available Rosharon USGS gage. Unlike most Texas estuaries the Brazos River lacks the typical enclosed bays and instead discharges directly into the Gulf of Mexico. The nekton of the lower Brazos River and estuary has been rarely monitored during the last 50 years. The primary objectives of our study were to characterize and determine the influence of river discharge on water quality and nekton in the Brazos River estuary. We conducted eight collections of nekton during November 2014 to May 2015 at nine sites extending from the mouth of the river to a point located 42 kilometers upstream. We also compared our results with data from past routine monitoring events and research studies to better characterize the response of nekton to a broad range of freshwater inflow. Based on the analysis of these data using statistical models we found distinct lateral and vertical gradients in salinity, dissolved oxygen, and nekton composition associated with river discharge. After adjusting for seasonality, we found that high and sustained freshwater discharges significantly altered the nekton community composition of the lower river. Further research and monitoring are needed over a range of flow regimes to better characterize the response of water quality and estuarine biota to varying freshwater inflow. This information is critically needed by both state water and natural resource managers.

Developmental instability – best summative measure of organismal health and environmental quality

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The best indication of species and environment health is the condition of organisms in the environment. A powerful yet, simple metric of organismal condition is developmental instability (DI). I present a broad conceptual framework that integrates DI with genetic, environmental, landscape, and toxicological data. Taken together, such a research program can identify causes of DI and be used to make geographic heat maps of each type of data block and each cross-variance among data blocks. For example, one might find DI is correlated spatially with certain land uses, and both of these may be correlated with particular toxins. Preliminary data are presented for three small pilot studies. DI was related to cadmium and copper in the coastal isopod (*Ligia*

occidentalis), mercury in pond turtles (*Emys orbicularis*), and radiation and population size in fruitflies (*Drosophila melanogaster*) near Chernobyl, Ukraine. The pilot projects indicate studies of DI could be extremely useful in natural conservation and resource management. The PI solicits project managers to include DI components in their work in collaboration with this PI.

Growth and reproduction of the Saltmarsh Topminnow (*Fundulus jenkinsi*) in Texas

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The Saltmarsh Topminnow, *Fundulus jenkinsi*, occurs sporadically within estuaries along the northern Gulf of Mexico and is listed as a species of concern by many of the Gulf coast states. The Saltmarsh Topminnow is under consideration for federal listing and given this species' restricted range in Texas, it is imperative to understand their growth and reproductive characteristics in order to better predict how disturbances will affect their overall abundance and population viability. Individuals collected from multiple sites in southeast Texas between February 17, 2014 and March 18, 2015 were counted, measured, and weighed. A total of 152 individuals were further dissected to assess reproductive condition. Standard lengths (mm) were displayed using length frequency histograms and no significant difference in length was found to exist across bay system, gender, or season (all p-values > 0.05). The software package FiSATII was used to establish tentative relative age classes. Standard length and total weight values from individuals were used to calculate a length-weight relationship of $y = 0.00005x^{3.0976}$ ($R^2 = 0.9872$). To assess the reproductive condition of *F. jenkinsi*, gonads were extracted and the mean gonadosomatic index (GSI) was calculated for each month. Monthly mean GSI values were significantly different across months for both females ($F_{10,76} = 31.58$; $p < 0.001$) and males ($F_{8,74} = 13.11$; $p < 0.001$). Both sexes exhibited higher mean GSI values in the spring and summer months and lower values in the fall and winter. Reproductive activity of females were further assessed by classifying the ovarian phase. Ovary phases were coded and linear regression analysis on these ranked scores were conducted to evaluate the relationship between season, standard length, and GSI values versus ovary development. Ovary phase exhibited a significant positive relationship with standard length ($R^2 = 0.265$, $p < 0.001$) and GSI values ($R^2 = 0.651$, $p < 0.001$). Ovarian development also showed signs of seasonal progression with greater numbers of more mature ovaries occurring in the summer and spring seasons.

Mercury monitoring in Texas waters of the Gulf of Mexico: a concurrent study with the national coastal condition assessment

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This presentation covers the prevalence of mercury in Atlantic Croaker (*Micropogonias undulatus*) in eight bays in Texas along the Gulf of Mexico. The data collection and analysis aspect of the research was conducted as a concurrent study with the 2015 May through August National Coastal Condition Assessment; an EPA-sponsored program that monitors the state of the United States coastal waters. The results gathered from this study will be added to historic mercury data from Atlantic Croaker and collected through other programs and independent researchers. In evaluating thirty years of data in mercury uptake and loading in Texas bay Atlantic Croaker this study seeks to determine what, if any, trends exist in order to better assist the federal, state, and local communities in regulating and monitoring mercury in the Gulf of Mexico.

Nursery Origin and feeding ecology of juvenile Bull Sharks in the northwest Gulf of Mexico

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Estuaries along the Gulf coast provide valuable nursery habitat for juveniles of several species of elasmobranchs (e.g. Bull Sharks), but questions as to how young sharks utilize these habitats remain central to their management. In this study, we determine the utility of vertebral chemistry to discriminate the nursery origin of Bull Sharks from putative nurseries along the Texas coast, and utilize stomach content analyses to further examine estuarine-specific feeding patterns. Juvenile sharks ($N = 142$) were collected opportunistically from five estuarine complexes along the Texas coast between Spring 2013 – Fall 2014. Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) was used to quantify elemental concentrations in vertebral tissue from a subset of 20 young-of-the-year sharks. Significant differences both in overall chemical signatures and individual elemental concentrations were revealed for sharks captured in different estuarine complexes, suggesting vertebral chemistry may be an effective technique in determining the nursery origin of Bull Sharks in Texas estuaries. Stomach contents from all individuals were identified to the lowest possible taxon, and four metrics of dietary composition were calculated: 1) percent frequency, 2) percent weight, 3) frequency of occurrence, and 4) index of relative importance (percent IRI) as an omnibus metric of dietary composition. Stomach contents of sharks from all bays were largely composed of teleost prey items (>95% IRI), with families Ariidae, Clupeidae, Mugilidae, and Sciaenidae dominating the teleost prey items in all dietary composition metrics. The reliance of these highly mobile euryhaline predators upon teleosts that also move regularly between marine and estuarine habitats underscores the need for further study into the role bull sharks play in the trophic connectivity of Texas nearshore systems.

Contribution of river, river-reservoir interface, and reservoir segments to the fish assemblage of a large Texas river-reservoir ecosystem

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Physical and hydrologic connectivity among river-reservoir ecosystem segments (river, river-reservoir interface [RRI], and reservoir) requires the consideration of management at this spatial scale for multiple objectives (e.g. ecosystem function, sport fisheries, and maximum fish diversity). However, limited data regarding the distribution of taxa within river-reservoir ecosystems currently inhibits such an approach. We quantified the fish assemblage of the middle Trinity River-Lake Livingston ecosystem using a stratified approach to determine the contribution of segments to the overall fish species composition. In general, fish assemblages varied along a continuum from the river to the reservoir; however, fish assemblages in several river backwaters did not conform to this gradient adding diversity to the overall assemblage. Variability among ecosystem segments was the result of both species composition and relative abundance. Species richness ($N = 58$ total) was highest in the river segment ($N = 55$) followed by the RRI ($N = 49$) and the reservoir ($N = 36$). In contrast, average catch per standardized unit of sampling effort (all species combined) was greatest in the RRI (2,027 fish) followed by the reservoir ($N = 1,362$) and river ($N = 587$). When looking across the ecosystem, 15 species (26%) were considered rare contributing < 0.01% to the standardized catch. Among the remaining 43 species, most ($N = 33$) inhabited

multiple ecosystem segments. These findings suggest that past efforts focused on specific ecosystem segments (e.g. reservoir or river) may have provided incomplete and potentially biased assessments for many species. We hope that these data will inform management activities and ensure that spatial scales used are appropriate for the species of interest.

Development of a middle Trinity River floodplain inundation model for assessing Alligator Gar recruitment

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Nolan Raphelt

Alligator Gar historically ranged throughout the Mississippi River Basin and in coastal river basins of the Gulf of Mexico from Florida to Mexico, but this species has seen a large range reduction due to anthropogenic impacts. The middle Trinity River in Texas still supports a large population of Alligator Gar, but is at risk due to increasing water demands in the Trinity River basin. To better manage and conserve this population it is important to understand the hydrologic factors that influence recruitment success, specifically floodplain inundation events. Utilizing an existing HEC-RAS 1-dimensional hydraulic model and 1-m LIDAR data, a high resolution inundation model is being developed for the middle Trinity River from the confluence of the Trinity River and East Fork Trinity River near Dallas to Lake Livingston. This inundation model will be utilized in conjunction with the Texas Ecological Systems Classification vegetation dataset to develop a flow vs suitable spawning habitat model. This model will then be applied to historical flows where data on adult year class structure will be utilized to develop relationships between hydrologic characteristics (flood pulse timing, duration, magnitude, frequency, etc...) and successful Alligator Gar recruitment.

The roles of introduced species, water quality, and hydrological modification in the conservation status of native freshwater fishes in central Mexico

P. Gesundheit

C. Macías-García

Central Mexico is the most densely populated area in the country and a region of considerable agricultural and industrial activity. It holds a unique freshwater fish fauna that, while not particularly rich, does include numerous endemic species, many of which are currently threatened. Aquatic systems in the region have been heavily disturbed by human activity, which has resulted in the extirpation of native fishes and the alteration of the fish fauna. Species introductions, pollution, and hydrological modification have all played a role in the decline of the native ichthyofauna. We present an overview of the conservation status of the fish fauna in the region and an analysis of the roles of these impacts. Local fish assemblages were sampled and water physicochemical parameters recorded at 64 localities within the region. We approximated the original composition of the fish assemblage at each location using historical records, graded the water parameters and aggregated them into an index of water quality, and estimated the level of hydrological modification for each sampled locality using a GIS-based approach. We used water quality, hydrological modification, and presence of introduced species as variables in a General Linear Model to explore the influence of each on the integrity of local fish assemblages. Numerical descriptors confirm a great amount of the fish diversity in this area of the country has been lost and the composition of the fish fauna as a whole has been greatly altered. Only 40% of the expected native populations were found in our sampling and only 30% of the sampled assemblages were free of introduced species. Mean species richness per locality was found to be only half of what historical records indicate. Both the presence of introduced species and water quality were significant in the linear model, while hydrological modification was not.

Fish community and habitat assessments within an urbanized spring-fed stream of the Edwards Plateau

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Spring systems along the Edwards Plateau of Central Texas are historical and contemporary diversity hotspots for endemic fishes. Flows of spring systems are dependent on karst aquifers, which are depleted by excessive groundwater withdrawals. Purpose of this study was to establish relationship between spring flow and biotic integrity in the Comal River system, a large spring system located in an urbanized area. Objectives of this study were to quantify spatial and temporal patterns in fish community densities, fish-habitat associations, and fish densities and habitat associations related to spring flow. Given that spring habitats range from wadeable to non-wadeable waters, we combined seining and SCUBA techniques to quantify fish community and habitat associations. To date, densities of spring fishes and habitat associations were quantified under a region-wide drought. Densities of spring fishes, most notably the federally-listed *Etheostoma fonticola*, decreased during a declining hydrograph, but seasonal reproduction by *E. fonticola* cannot be excluded as a possible mechanism in the decline. Study results will guide conservation efforts in protecting the spring system from excessive withdrawals from the underlying aquifer.

Fish kill drill comparisons

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The Texas Parks and Wildlife Department's Kills and Spills Team (KAST) is made up of a group of specially trained biologists that investigate pollution events that may have impact to state fish or wildlife resources. KAST members consist of staff from both Inland Fisheries and Coastal Fisheries Divisions, and are housed in offices in Austin, Waco, Tyler, Dickinson, and Corpus Christi. KAST members conduct their job duties under a divisionally approved standard operating procedure and they follow methodology published in the American Fisheries Society (AFS) Special Publication 30, entitled Investigation and Monetary Values of Fish and Freshwater Mussel Kills. This document describes the methodology used during fish and mussel kill investigations. Approximately every other year KAST members get together and conduct fish kill drills to practice this methodology. In years past, this training consisted of deploying recently thawed frozen fish to a pre-determined drill location near one of the regional offices which is hosting the drill. Due to some inherent problems of using freshly thawed frozen fish, team members have discussed the need to utilize some medium other than frozen fish to test the skills of the team. In the June 2015 fish kill drill hosted by the Tyler Regional office, a novel method to test the AFS methodology was used and evaluated with great success. Instead of freshly thawed frozen fish, Tyler KAST staff prepared and deployed in excess of 4300 pieces of swim noodles in Saline Creek on Lake Palestine, with the different colors representing various fish species. This presentation will describe the 2015 drill as well as make some comparisons between this drill and past drills.

Evaluation of phenotypic-Guadalupe Bass (*Micropterus treculii*) in the Colorado River below the city of Austin, Texas

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The native ranges of Guadalupe Bass (*Micropterus treculii*) and Spotted Bass (*M. punctulatus*) converge at the Colorado River drainage in Texas. Abundant and large phenotypic-Guadalupe Bass are commonly reported by anglers fishing these sympatric waters, and recently (February 2014) the new state-record Guadalupe Bass was angled here. While there is little evidence of hybridization in the literature we hypothesized that large phenotypic-Guadalupe Bass were the result of introgression with Spotted Bass given that Spotted Bass are noted to attain a larger overall size. Phenotypic-Guadalupe Bass were angled from seven sites on the Colorado River ($n = 85$) between July 2012 and April 2014. Sites were distributed along a 250 km river-stretch between the city of Austin and the city of Columbus, TX. Lengths and a fin-clip were obtained from each angled fish, and subsequently isolated DNA was used as a template to sequence a nuclear and mitochondrial gene in a representative subset of samples ($n = 46$). Sequencing indicated 12% and 10% introgression at the nuclear and mitochondrial markers, respectively, with 72% of samples exhibiting no signs of hybridization. Introgression generally increased downstream; but by length, non-introgressed Guadalupe Bass were significantly larger ($P = 0.002$) than introgressed samples in the collection. No fish ≥ 305 mm showed signs of introgression, including the new state-record fish. This suggests that hybridization occurs in the Colorado drainage but is not the basis for the large size of Guadalupe Bass in the system. Enhanced size among resident Guadalupe Bass may instead be the result of high trophic productivity, which departs dramatically from the clear Texas Hill Country streams that serve as the main biotope for Guadalupe Bass.

Effect of hatch date on first-summer growth of four Great Plains cyprinids

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We collected young-of-year of four cyprinids: Red Shiner *Cyprinella lutrensis*, Plains Minnow *Hybognathus placitus*, Sharpnose Shiner *Notropis oxyrhynchus*, and Smalleye Shiner *Notropis buccula*, from the upper Brazos River drainage during 2008-2010. We identified fish to species, measured total length (TL) to the nearest millimeter, and removed the largest pair of otoliths, the sagittae, from each fish. Otoliths were polished and cemented to microscope slides for analysis. Plains Minnow, Sharpnose Shiner, and Smalleye Shiner generally spawned and produced young from March through September in 2008-2010. Red Shiner began spawning slightly later in the year, from early April, but also spawned through September in all three years of the study. Mean daily increase in length (growth) was highly variable in all species in all years of our study and ranged from 0.20-0.82 mm per day for Red Shiner, 0.25-1.20 mm per day for Plains Minnow, 0.20-1.14 mm per day Sharpnose Shiner, and 0.29-1.13 mm per day for Smalleye Shiner. For all species, maximum growth increments were greater in 2008 and 2009 than in 2010. There was a significant positive ($P < 0.001$) relationship between log length and log age for all species in all years of our study, with length explaining 44 to 96% of the variation in age. Regression slopes ranged from 0.886 (Sharpnose Shiner, Double Mountain Fork Brazos River, 2010) to 1.500 (Smalleye Shiner, Brazos River, 2009), suggesting relatively little variation in average daily growth increments among species, sites, and years. To assess the effect of hatch date on growth we used multiple regression to adjust for the effects of age on length. There was a negative relationship between hatch date and length for several species-year combinations indicating that individuals spawned earlier in the season grew at a greater rate than those spawned later.

POSTER SESSION ABSTRACTS

Population genetics of the Blue Crab, *Callinectes sapidus*, in the Gulf of Mexico and Atlantic Coast: Progress report

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The blue crab is a keystone species in estuarine habitats, serving as both predator and prey to other species. It plays a pivotal ecological and economic role in the Gulf of Mexico and the US mid-Atlantic region, being one of the most important fisheries in these regions. Unfortunately, it has been suffering a population decline, which could lead to a loss of genetic diversity and negatively impact this species, as well as the organisms that depend on it, such as the critically endangered Kemp's Ridley sea turtle and the whooping crane. It is important to obtain baseline genetic data that can be used to examine changes in genetic diversity in this species. Furthermore, it is also important to better understand genetic population structure in this crab, for more effective management of this fishery, as previous research on this topic has been inconclusive. To better understand spatial and temporal genetic variability of the blue crab, we characterized genetic diversity and estimated population genetic differentiation among three areas using 20 informative microsatellites: (1) the Chesapeake Bay (n = 24), in the Atlantic coast; (2) Lower Laguna Madre (LLM), in Texas (n = 24); and (3) Cedar Key, in the Gulf coast of Florida (n = 24). These locations were chosen because of their potential to show population genetic differences due to their geographic distance and environmental differences; allowing for comparisons between the Atlantic coast and the Gulf of Mexico; the East vs. West Gulf; different salinities (LLM is hypersaline); and different temperatures. Allelic diversity, heterozygosity, and conformance to Hardy-Weinberg equilibrium were calculated for each population. To test for population genetic differentiation, we used conventional F-statistics and cluster-based analyses.

Population genomics of the blue crab *Callinectes sapidus* in the Gulf of Mexico and Atlantic US: Progress report

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The blue crab, *Callinectes sapidus*, is one of the most important commercial fishery species in the Gulf of Mexico and U.S. Atlantic coast. Due to overexploitation and habitat destruction and modification, the blue crab fishery has suffered drastic declines in recent decades. Despite its importance for management and conservation, comprehensive knowledge of population structure and genetic differentiation of blue crab populations in the Gulf of Mexico and Atlantic US is lacking. In the current study, we collected blue crabs from different locations in the Gulf of Mexico and Atlantic US, and investigated their genetic diversity and population structure using the double digest restriction site associated DNA (ddRAD) sequencing method. ddRAD is a reduced-representation genome sequencing strategy that involves genomic DNA digestion with two restriction enzymes, size selection of resulting fragments, and high-throughput sequencing. Usually, thousands of single nucleotide polymorphisms (SNPs) are detected in the sequences, which are used for population genomic inferences. We have conducted RAD-seq for populations throughout the Gulf of Mexico, and will soon include populations from the Atlantic. Given the large

number of markers used, our study will provide robust inferences on the population structure of blue crabs in the Gulf of Mexico and Atlantic US. This information will contribute to a better management of this important fishery.

Life-history characteristics and diversification within freshwater fishes of North America

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North America supports a great diversity of freshwater fishes, comprising >1,400 described species, however, diversification rates are not homogenous among lineages. Life-history characteristics (e.g., age of maturation) are associated with diversification rates among non-piscine lineages, but diversification rates related to life-history characteristics have not been assessed for North American piscine lineages. Purpose of this study was to assess diversification (i.e., number of described species) among piscine orders, families, and genera related to a suite of life-history characteristics, including age of maturation, feeding guild, maximum length, longevity, reproductive season length, and reproductive guild. Preliminary results suggest that life-history strategies, in particular age of maturation, longevity and maximum total length, are related to greater number of species among taxonomic levels, although a few confounding life-history characteristics obscured patterns. Life-history strategies likely contribute to diversity discrepancies among lineages and can provide insights into the speciation process.

Population status and life history attributes of the Texas Shiner *Notropis amabilis*

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Purposes of this study were to assess population status and life history attributes of the Texas Shiner *Notropis amabilis*, a minnow endemic to the Edwards Plateau region in Texas and the Rio Grande of USA and Mexico. Despite possible extirpation from two stream reaches, populations of Texas Shiners persist with occasional and frequent abundances among multiple and independent streams, stream reaches, and drainages. Therefore, we tentatively consider Texas Shiner population as stable. Quantification of life history traits suggest that Texas Shiner has a protracted reproductive season (i.e., nine months), has a maximum age of two years, and is a drift feeding invertivore. Protracted spawning seasons are consistent with Texas Shiner's reported associations with spring systems of the Edwards Plateau. Current and future conservation of *N. amabilis* and other spring-associated fishes are explicitly linked to spring complexes though the exact mechanisms of association are unknown.

Genetic characterization of *Barbus* (Pisces, Cyprinidae) diversity in Lake Victoria drainage basin, Kenya

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Barbus is a speciose, taxonomically complex and heterogeneous cyprinid genus. In Lake Victoria drainage basin in Kenya, eight endemic species of *Barbus* are reported, which constitute important local fisheries. Although these species have been evidenced using morphological characters, confusion may occur when trying to distinguish morphologically similar species. Genetic characterization can aid to better understand the diversity of *Barbus* lineages present in this region, which is important for conservation and management. Between October and December 2014, 400 fish belonging to the eight putative *Barbus* species reported in Lake Victoria drainage basin in Kenya were sampled from eight rivers, four refugia sites, and one lacustrine environment. A subsample, representing the eight putative species was genetically characterized by sequencing fragments of the mitochondrial genes Cytochrome b ($n = 34$) and NADH-2 ($n = 54$). Maximum Likelihood and Bayesian phylogenetic analyses of these sequences, including reported sequences of *Barbus* species in Africa, will shed light on the diversity of *Barbus* lineages present in the study area and their evolutionary relationships.

Influence of the annual flood-pulse on abundance, condition and reproduction of *Clarias gariepinus* (Burchell 1882) in the upper Okavango Delta, Botswana

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The flood-pulse is the major driver of fish population dynamics in large floodplain river systems. The biology of *Clarias gariepinus*, an important species in the subsistence fishery of the Okavango Delta, is closely tied to the annual flood pulse. Catch per unit effort (CPUE), length, weight and maturity data for *Clarias gariepinus* were collected during monthly gill net surveys in the upper Okavango Delta between 2001 and 2009. CPUE, condition factor (K) and the proportion of ripe and running fish (P_{RR}) in the population followed a unimodal annual cycle that could be modelled using water temperature and flood-pulse hydrology. Increased CPUE during declining water levels was most likely a result of feeding migrations and aggregation behavior. The observed increase in K during low floods in October and November preceded the increase in P_{RR} which increased mainly with increasing temperature but appeared less dependent on flow. This study provides quantitative evidence to support the conceptual model that the annual flood pulse is the major driver of fish reproduction, abundance and feeding habits in the Okavango Delta, thus emphasizing the need to maintain natural flow regimes for successful management of fishery resources in the face of climate change.

Genetic evaluation of Channel Catfish (*Ictalurus punctatus*) restocking in Texas

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Channel Catfish is one of the most economically important species in farming and sport fishing in the US. In Texas, Channel Catfish has been restocked since 1941; using hatchlings of the Imperial strain for restocking. The objective of this research is to determine genetic diversity and population differentiation of channel catfish between hatcheries used for restocking and restocked reservoirs in Texas. We obtained samples of the Imperial

strain from two different hatcheries (i.e., San Marcos and Texas A&M) and 12 reservoirs. For comparison, we also included a reservoir and three wild populations from Tamaulipas, Mexico. A total of 150 animals were genotyped with 12 microsatellites. For each population, we estimated genetic diversity and inbreeding. For the inference of genetic structure, a Bayesian cluster method was used. On average, the effective number of alleles per microsatellite loci was 10. We detected deviations from Hardy-Weinberg Equilibrium in all populations for all markers; 16 populations showed a deficit of heterozygotes. Three clusters were identified among the populations: (1) one included the Imperial strain from San Marcos and 2 reservoirs from Texas, (2) a second, the Imperial strain from Texas A&M, 10 reservoirs from Texas, Rio Bravo/Grande samples and the reservoir from Tamaulipas, (3) the three wild populations collected in rivers from Tamaulipas. Although previous studies indicate the Imperial strain hatchlings presented high mortality rates due to low environmental conditions in West Texas reservoirs in comparison with wild individuals, Imperial strain genotypes were found in all Texas reservoirs and in the Rio Bravo.

Can passive acoustic monitoring provide estimates of Burbot spawning activity?

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Burbot *Lota lota* is the sole freshwater representative of the cod-like fishes and is a commercially and recreationally important species found worldwide above approximately 40° N. It is a difficult species to effectively manage due to its preference for deep-water habitats and that its spawning and other aspects of its early life history are completed under the ice in winter. Like most gadiform fishes, Burbot use acoustic signaling as part of their mating system, and while the acoustic repertoire of the species has been characterized under artificial conditions, there has been no work to determine whether the species is as vocal in natural spawning aggregations. Our objective was to assess the feasibility of collecting and using acoustic data to characterize the spawning activity and locations of Burbot under field conditions. We recorded audio and video of Burbot spawning aggregations through holes drilled into the ice at known spawning grounds at Moyie Lake in British Columbia, Canada. Acoustic recordings were analyzed using Raven Pro v 1.4 to count the number of calls and their characteristics. Acoustic behavior was also related to the video data to determine how acoustic activity correlates to any observed spawning behavior. In general, wild Burbot spawning in Moyie Lake do not vocalize as frequently as counterparts spawning under artificial conditions. Further, Burbot vocalizations were not recorded in conjunction with spawning activity. While it may be feasible to use passive acoustic monitoring to locate Burbot spawning grounds and identify periods of activity, it does not seem to hold much promise for quantifying spawning activity.

Effect of pond permanence on aquatic insect-mediated flux of methylmercury to terrestrial ecosystems

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Humans have built millions of small farm ponds in the Great Plains of the United States, and these ponds have become contaminated with atmospherically-deposited mercury (Hg). In aquatic ecosystems, less toxic forms of Hg deposited from the atmosphere are converted to highly toxic methylmercury (MeHg) and this MeHg can contaminate terrestrial food chains when MeHg-contaminated insects emerge as adults. Permanent and temporary ponds have been hypothesized to have different insect-mediated MeHg flux but this has not been tested. Our first objective was to assess the number of temporary and permanent ponds in the Great Plains using federal topographic and image databases. We estimated that there were 698,523 farm ponds ≤ 10 ha in a 229,489 km² region of the southeastern Great Plains (3.04 ponds per km²) and 44% of these ponds were temporary. Our second objective was to compare insect-mediated MeHg flux from permanent and temporary ponds. We conducted an experiment at the Eagle Mountain Fish Hatchery (Fort Worth, Texas) in five permanent ponds that were stocked with fish and five temporary ponds that were dried and refilled prior to the start of the experiment. Initially, large and small insect taxa (e.g. dragonflies and midges, respectively) emerged from the permanent ponds but only small taxa emerged from the temporary ponds. Dragonflies did not emerge from the temporary ponds until one month after refilling. Despite low MeHg flux from temporary ponds immediately after refilling, the cumulative MeHg flux was greater in the temporary ponds than in permanent ponds within one month of the start of the experiment. This study suggests that temporary ponds are important components of the hydrologic landscape in the southeastern Great Plains and that insect succession in the summer is rapid enough that MeHg flux can be greater in temporary ponds than permanent ponds where fish suppress insect emergence. .

Assessment and monitoring of newly established public river access and conservation areas

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Healthy, naturally-functioning rivers provide environmental services, recreational opportunities, and support other societal and economic benefits. However, public river access in Texas is often limited, preventing the societal and economic benefits of these systems from being fully realized. Therefore, the River Access and Conservation Area Program was developed to expand recreational access to rivers and streams to the public via private lands through long-term lease agreements between state resource agencies and private landowners. However, it is not clear what impact increasing public access to rivers might have. Further, understanding the potential impacts to the newly accessible river segments and how to manage them sustainably requires precise estimates of how the public is using these sites. This objectives of this study are to develop protocols for conducting baseline assessments and monitoring of riparian and instream habitats, biological resources, and public

use at newly acquired public access lease sites, and to use the results from these surveys to determine the best management practices to apply at these sites to both ensure healthy rivers and streams and public satisfaction. Belt transects were conducted to assess instream and riparian habitats and standardized electrofishing surveys have been conducted to assess the composition of the fish assemblage near the lease sites to determine the size distribution of targeted sportfish, such as Largemouth Bass *Micropterus salmoides* or Channel Catfish *Ictalurus punctatus*. Game trail cameras were deployed along with a volunteer use survey to assess the intensity of use and quality of experience at each site. Analysis of initial baseline data from a subset of the access areas has shown areas of highest priority for riparian restoration, use monitoring, and possible modifications to fishing regulations. Continued monitoring of the subset of sites, along with additional site surveys will aid in creating an adaptive management strategy.

Diet and life history of the Brown Madtom (*Noturus phaeus*) in Louisiana

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The Brown Madtom, *Noturus phaeus*, is a moderately sized nocturnal madtom species found occupying dense woody cover in streams of the Mississippi River tributaries, and the Sabine River and the Bayou Teche drainages. Of 27 madtom species, over half have been state or federally listed, and currently make up six of seven Ictalurid species protected under the federal Endangered Species Act. The length of the brown madtoms collected from Fort Polk, LA were recorded, then the pectoral spines were aged by counting annuli. These data were then analyzed by comparing length-at-age curves. The proportion of invertebrates found in gut contents and field were used to formulate Strauss's Linear Index. According to the von Bertalanffy growth model, *N. phaeus* follows the standard growth curve. The brown madtoms' foraging habits tend to reverse between winter 2004 and summer 2015 according to Strauss's Linear Index. Basic life-history information is not only useful for management of *N. phaeus*, but might also provide insight into life histories of related madtom species, ultimately leading to improved practices for future madtom conservation. This work will continue in summer 2016 so better comparisons can be made across years.

Gut microbial symbioses in freshwater fishes

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Emerging research continues to shed new light into how the vertebrate gut microbiome influences health and disease, nutrient uptake and growth, and even behavior. Recent advances in biotechnology allow exploration of this diverse ecosystem at finer resolution than ever before and increases the scope of applications. This is especially evident in human health, and major advances in human-microbe symbioses may foreshadow similar interactions in vertebrates in general. However, recent work in non-human vertebrates is primarily from laboratory or zoological specimens and microbial symbioses in fishes are poorly understood. A recent review highlighted the potential importance of the fish gut microbiome for conservation, ecosystem management, and aquaculture capabilities, as well as current information gaps that need attention. While it is expected that the microbiomes of fishes will be less diverse than those of higher vertebrates, studies into probiotic use in aquaculture have shown that the microbiome has a profound effect on health and behavior in fishes. Here we synthesize modern gut microbiome literature on determinants of vertebrate gut microbial composition/diversity as well as specific functions of microbial taxa potentially important to the fish gut microbiome and host ecology. Using our nascent research on ecological determinants of the gut microbiome of fishes in a tropical floodplain and in streams of the southern plains, we describe potential applications of such research to fish foraging ecology, growth, behavior, response to disturbance and for aquatic food webs and ecosystems.

Ontogeny of oromandibular structures in the algivorous and federally endangered Devils River Minnow, *Dionda diaboli*, with an overview of trophic adaptations for algivory in North American minnows (Teleostei: Cyprinidae)

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The Devils River Minnow, *Dionda diaboli*, is a federally threatened species of minnow endemic to tributaries of the Rio Grande in south central Texas and adjacent Mexico. *Dionda diaboli* is planktivorous in the early larval stage and undergoes an ontogenetic dietary shift to algivory toward the end of the larval stage, concomitant with changes in gut morphology. In addition to elongating the alimentary canal, algivorous minnows typically also exhibit trophic modifications that facilitate removal of algae from the benthos, including cornification of the lips and in some cases even the jaw epithelium. Oromandibular surfaces in *D. diaboli* are likely also cornified but the extent and ontogenetic timing of oral cornification is currently unknown. In this study, we use a combination of scanning electron microscopy (SEM) and histology to investigate ontogeny of the trophic apparatus in *D. diaboli* based on captive raised larvae and juveniles representing six size classes (7.0, 9.0, 10.0, 15.0, 22.0, and 25.0 mm) and two adult age classes (6 months and 1 year). We specifically address the following questions: (1) what is the extent of oral cornification in *D. diaboli*; (2) at what point in development does oral cornification commence in *D. diaboli*; and (3) what (if any) is the relationship between oral cornification and gut elongation in the ontogeny of *D. diaboli*. We also outline the broader applications of our research for the captive propagation of *D. diaboli* and other species of algivorous minnows.

Biomonitoring of the Syr Darya River (Kazakhstan): Chemical contamination and biological effects

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The Syr Darya is one of the largest rivers in southern Kazakhstan and is a major source of freshwater feeding the Aral Sea. In the 1950s, water was diverted from the Syr Darya to support agricultural production leading to the drying of the Aral Sea, which has been characterized as one of the worst environmental catastrophes in modern day history. Efforts to revive the Aral Sea are underway, yet few investigations have sought to assess the impacts of agrichemicals and other contaminants in the Aral Sea Basin, including the Syr Darya. As such, the goal of this study was to assess the presence and biological effects of contaminants in the Syr Darya River. This was accomplished by collecting water and sediment samples from five sites along the Syr Darya and roach (*Rutilus rutilus*) samples from three sites. Water and sediment samples were analyzed for a suite of pesticides, heavy metals and radionuclides, while roach tissues were analyzed for the expression of genes considered to be biomarkers of contaminant exposures (i.e., heat shock protein 70, cytochrome P450 1a, vitellogenin, etc.). Chemical analysis of water and sediment revealed the presence of lindane at each of the sites and 4,4-DDE at three of the sites. Roach from two of the three sites experienced alterations in the expression of genes considered biomarkers of contaminant exposure suggesting that chemical loads at some of the sites in the Syr Darya were sufficient to induce biological effects. Data collected as part of this study will be utilized to complete an ecological risk assessment in the Syr Darya River basin.

Influence of salinity and other water quality variables on growth of ichthyotoxic golden alga

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Golden alga (*Prymnesium parvum*) is a toxigenic harmful alga native to marine/estuarine habitats that has also invaded inland brackish waters, causing severe ecological damage. Blooms typically occur in late winter or early spring. The most common strain found in Texas is genetically associated with a strain found in Scotland (Texas strain). A field study of the Pecos River reported the unexpected finding of an apparent upper salinity limit of ~20 ppt for golden alga presence. Other field studies reported positive associations with sulfate concentrations. The objective of this study is to experimentally characterize the influence of salinity (NaCl, 5-30 ppt), sulfate (nominal 0-1000 mg/mL), and temperature (22 or 13°C) on growth of the Texas strain. For comparative purposes, the effects of salinity were also tested using an English strain of golden alga. Stationary (maximum) cell densities for the Texas strain were achieved at 21-24 and 42-45 days at 22 and 13°C, respectively, and for English strain at 39-42 days at 22°C. Maximum cell densities of the Texas strain increased as salinity increased from 5 to 15 ppt but decreased at higher levels regardless of incubation temperature. The same general pattern was observed with the English strain, with maximum cell densities observed at 10 ppt. At constant salinity (5 ppt), cell densities of the Texas strain were positively associated with sulfate. These laboratory tests confirmed the biphasic growth pattern of golden alga in relation to increasing salinity first suggested by field studies, and also showed that the pattern is independent of temperature or genetic strain. The positive association between sulfate and growth is also consistent with field observations. Information may be useful to inform management strategies based on water quality indices to curb the incidence and prevent the further spread of golden alga blooms.

Molecular characterization of *Hypostomus* (Osteichthyes, Loricariidae) diversity in the south and southeast regions of Brazil

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The *Hypostomus* genus has around 130 recognized species, which are highly diverse and are distributed from Costa Rica to Argentina. *Hypostomus* is of ecological and economical importance in the neotropical aquatic ecosystems. This genus is one of the most complex in the Siluriforme order, because its body is covered with bony plates and it has ventral mouth. However, little is known about its taxonomy, phylogeny, biogeographic range and the natural processes involved in the diversification and morphological variation for this genus. There is morphological, karyotypical and isozymical variation in different populations, suggesting of a species complex. Due to the absence of complete description, species identification is difficult. Currently, nothing is known about its genetics. To characterize the species and to promote a systematic, taxonomic and phylogenetic knowledge of this genus, it was necessary to develop a detailed morphological and molecular study. The study of species is being held with two mitochondrial DNA loci, NADH dehydrogenase 2 (ND2) and Cytochrome c oxidase I (COI) and tree nuclear DNA loci, Recombination activating 1 and 2 (RAG1 and RAG2) and Ribosomal protein S7 (S7), were sequenced 51 samples of 3 localities. Preliminary results neighbor- joining tree from ND2 gene show some relationship between morphological and molecular data.

Influence of climate change, freshwater inflows, and changing land use on the distribution of Dwarf Seahorse on the Texas coast

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Syngnathid fishes, such as seahorses and pipefishes, are in decline worldwide due to anthropogenic disturbances, primarily habitat loss or degradation due to changing climate and coastal development, and unsustainable exploitation. Dwarf Seahorse *Hippocampus zosterae* inhabits Texas bays, usually associated with seagrasses. The species is considered a candidate for federal protection primarily due to population declines in Florida, but virtually nothing else is known of their distribution, population status, or habitat requirements. Our objectives were to assess the distribution and habitat use of Dwarf Seahorse in Texas and identify threats to its persistence. We used data collected during the Texas Parks and Wildlife Coastal Fisheries Division's fishery-independent surveys to develop species distribution models (SDMs) evaluating environmental factors influencing the distribution of Dwarf Seahorse. We used WorldClim climate data, physicochemical data from NOAA, land cover data from the Texas Ecological Classification Project, and seagrass distribution data from the TPWD Seagrass Monitoring Workgroup were incorporated into the models as influential factors on Dwarf Seahorse distribution. Distance to the nearest public boat ramp was used as a proxy variable for physical anthropogenic disturbance of seagrass habitats. In addition to survey data from other sources, primarily the Fishes of Texas database, selected sites within the six major bay systems on the Texas coast were surveyed using seines and push nets to generate data to validate the SDMs. Understanding the factors influencing the current and future distribution of Dwarf Seahorse is an important first step towards determining the viability of the species in Texas waters.

Enhancing the fish embryo toxicity test: growth, developmental abnormalities and gene expression as additional endpoints

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To protect aquatic resources and fisheries, municipal and industrial effluents are subject to routine toxicity testing prior to discharge. The standard method of effluent toxicity testing in the United States, the larval growth and survival (LGS) test requiring the use of fathead minnows, is a method of quantifying changes in larval growth and mortality in response to chemical and effluent exposure. Animal welfare concerns have led to the development of alternative testing strategies that utilize embryonic fish, rather than larvae. Such fish embryo toxicity (FET) tests may be useful alternatives to current testing methods here in the United States; however, there are still limitations associated with the FET test. Specifically, the FET test lacks sublethal endpoints that can be utilized to predict chronic toxicity and identify sublethal adverse effects. The objective of this study was to enhance the FET test by determining whether the inclusion of sublethal metrics such as growth, developmental abnormalities and gene expression could increase its sensitivity. Fathead minnow FET and LGS tests were conducted using three reference toxicants (sodium chloride, sodium dodecyl sulfate and ethanol). Results revealed that the FET and LGS tests were similar in their ability to predict acute toxicity indicating that the FET is a viable

replacement for the LGS for acute toxicity assessments. Embryos subjected to the FET tests experienced reductions in growth, increases in the incidence of pericardial edema and alterations in the expression of genes associated with growth and toxicity, suggesting that each of these endpoints may enhance the predictive power of the FET tests.

A scanning electron microscopy study of variation in tuberculation across the range of the Sand Shiner (*Notropis stramineus*)

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The Sand Shiner *Notropis stramineus* (Cope 1865) is a small, widespread species of North American minnow found in small rivers and streams from southern Canada to Northern Mexico. Recent analyses of unpublished genetic data from multiple loci has revealed several geographically isolated populations of Sand Shiners to be highly divergent (uncorrected p-values 6-10% between certain populations; 0-1% within populations) suggesting that *N. stramineus* may represent a species complex of similar looking, yet genetically distinct species. The current classification of Sand Shiners, comprising two subspecies (*N. s. stramineus* and *N. s. missouriensis*) would be sufficient to accommodate the currently unrecognized diversity within *N. stramineus* (*sensu lato*) yet there are no known morphological traits that can be consistently used to distinguish between (or diagnose) subspecies. Members of the Cyprinidae often display sexual dimorphism in the size and abundance of tubercles (keratinous epidermal projections scattered across the surface of the head and body) and characters of tuberculation have been used previously to distinguish between closely related (and potentially recently diverged) sister taxa. Using scanning electron microscopy (SEM), I investigate the pattern, relative size, and location of tubercles on reproductively active males of *N. stramineus* belonging to different genetic lineages (identified a priori as belonging to different subspecies) to assess the utility of this character complex for distinguishing between putative species within the Sand Shiner species complex.

Ontogeny of the catfish stinger

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Catfishes (Siluriformes) are characterized by an impressive number of skeletal autapomorphies, including the anteriormost pectoral-fin ray highly modified into a lockable spine, which in some species may be associated with a venom gland. Previous anatomical investigations of the catfish pectoral spine have focused largely on the adult stage and have clarified how the spine locks into place and how it grows via the addition of segments distally. Detailed information on the earliest stages in the development of the catfish pectoral spine is not currently available leaving a number of questions about the development of the catfish stinger unanswered (e.g., at which point in development do the hemitrichia of the anteriormost fin ray fuse to form a single element?). Using a combination of clearing and double staining and serial sectioning, we document the earliest stages of pectoral spine formation in two species of ictalurid catfishes (*Noturus gyrinus* and *Ictalurus punctatus*) and compare early pectoral-fin ray development in ictalurids to non-siluriform otophysans.

Evaluation of fish and macroinvertebrate assemblages associated with *Panicum spp.* in Lake Conroe, Texas

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Torpedograss (*Panicum repens*) and Maidencane (*Panicum hemitomon*) are invasive non-indigenous perennial species of grass in the family Poaceae which inhabit wetlands and other naturally aquatic areas in multiple tropical and temperate regions of the world. Currently in Lake Conroe, Montgomery County, Texas, the most prevalent emergent macrophytes are mixed assemblages of Torpedograss and maidencane, which dominate the majority of the shoreline. The purpose of this study will be to evaluate the fish and macroinvertebrate assemblages associated with these plant species, as such an evaluation has not been completed in Lake Conroe. To accomplish this, 5 meter by 1 meter areas of shoreline *Panicum spp.* will be categorized into three categories based on density: sparse, medium and dense coverage. Samples of areas barren of vegetation will also be taken. Five sites of each category will be randomly sampled for a total of 20 sites. Fishes within these sites will be sampled by exhaustive electrofishing. Macroinvertebrates will be sampled by using a 1m² cylindrical enclosure trap, often known as a Wilding sampler or drop sampler, as it is an effective method when sampling epibenthic and epiphytic habitats. Water and plant material above the benthic layer from within the drop sampler will be collected and evaluated for the presence of macroinvertebrates; and, two liters of soil will also be collected to ensure the evaluation of benthic macroinvertebrate species. It is hypothesized that increasing density of *Panicum spp.* will correlate with an increase in macroinvertebrate abundance and species richness. It is also hypothesized that fish abundance and species richness will increase in medium densities, but will decrease in areas of sparse and dense *Panicum spp.* coverage.

Bioblitzing as a tool for monitoring native fishes of greatest conservation need

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For the past two years the Fishes of Texas Project team in collaboration with Texas Parks and Wildlife Department has conducted detailed aquatic bioassessments, “bioblitzes,” within identified Native Fish Conservation Areas (NFCAs) throughout the state. During bioblitzes, data is collected on aquatic and riparian communities, habitats, and recreational use of target sites. This work is done with the help of numerous community partners and addresses multiple goals, including: providing data and recommendations to local conservation management partners, developing a framework for continued citizen-science based surveys, and filling gaps in historical fish records. One recent study area was the Big Cypress Basin in which aquatic bioassessments were conducted at 4 sites and supplemental fish surveys were done at 14 sites. As with all the bioblitz sites, this data will help narrow the focus of conservation monitoring efforts throughout the state.

The distribution of Golden Alga in the Brazos River and Rio Grande Basins

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Harmful blooms of golden alga (*Prymnesium parvum*) were first reported in the Pecos River (Texas) in the 1980s, and the species is now present in at least 23 states. Several surveys have been conducted to determine the distribution of golden alga in surface waters of the USA, but most of these surveys used relatively insensitive techniques such as hemocytometry. In addition, there are ecologically important or sensitive areas in Texas that have not been methodically surveyed before. The objectives of this study are to determine the distribution of golden alga in the Brazos River and Rio Grande River basins using standard hemocytometry and the highly sensitive eDNA analysis approach (quantitative PCR), and also to assess their association with water quality. Sampling sites on the Brazos River include the North and South Forks of the Double Mountain Fork (DMF), the DMF, and mainstem locations downstream to Possum Kingdom Reservoir. The majority of these sites are within Critical Habitat for two newly listed fishes, *Notropis oxyrhynchus* and *N. buccula*. Site on the Rio Grande Basin include Salt Creek, a Pecos River tributary containing what may be the last genetically pure population of Pecos Pupfish (*Cyprinodon pecosensis*), and the Trans-Pecos Region of Rio Grande which includes the Big Bend area, one of the most unique desert ecosystems of North America. A total of 26 sites were sampled in fall of 2015 and will be sampled again in spring of 2016. Results of hemocytometry suggested the presence of golden alga in a spring-fed pond within Big Bend National Park. If eDNA analysis confirms this finding, it would represent the first report of golden alga in a stretch of nearly 1000 river-kilometers of the Rio Grande and potentially prompt reassessment of the risk posed by golden alga to the aquatic fauna of the region.

Uses of Water Willow (*Justicia americana*) by Reservoir Fishes and Invertebrates in Lake Conroe, Texas

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Water-willow (*Justicia americana*) is popular in fish habitat improvement projects because of its ease of establishment and relative resistance to herbivory by Grass Carp (*Ctenopharyngodon idella*). However, the response by the fish community to water-willow establishment has not been well documented. In this study, 9,322 plots of water-willow established by Texas Parks and Wildlife Department in Lake Conroe, Montgomery County, Texas were block netted then electrofished exhaustively to capture all possible fish in the treatment sites across multiple seasons. Fish were identified to species then weighed to the nearest gram and measured to the nearest mm total length. A half meter diameter plankton net was used to collect water column and stem samples. These stems were extracted used for patch stem density calculations and invertebrate collection. A 3.7 liter sized bucket was used to collect benthic samples. Invertebrates collected from water-willow stems were identified to the farthest taxa. Stomach contents were examined to determine food habits. Similar sampling was conducted in un-vegetated sites along shoreline unassociated with water-willow sites. Species composition, size composition by species, fish condition, and stomach contents were compared between water-willow and un-vegetated sites. Preliminary results suggest that biodiversity within water-willow sites is greater than in un-vegetated control sites.

Disentangling interactive effects of oxygen and flow rate on fish body shape

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Environmental factors influence phenotypes directly as well as indirectly via trait correlations and interactions with other environmental variables. Using nine populations of the African cyprinid *Barbus neumayeri*, we employed path analysis to examine direct, indirect, and total effects of two environmental variables: water flow (WF) and dissolved oxygen (DO) on several morphological traits. WF and DO directly influenced relative gill size, body shape, and caudal fin shape in manners consistent with a priori predictions. Indirect effects also played an important role in the system: (1) strong, oppositely signed direct and indirect effects of WF on body shape resulted in a non-significant total effect; (2) DO had no direct effect on body shape, but a strong total effect via indirect effects on gill size; (3) WF indirectly influenced gill size via effects on DO. Only through examination of multiple environmental parameters and multiple traits can we hope to understand complex relationships between environment and phenotype.

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