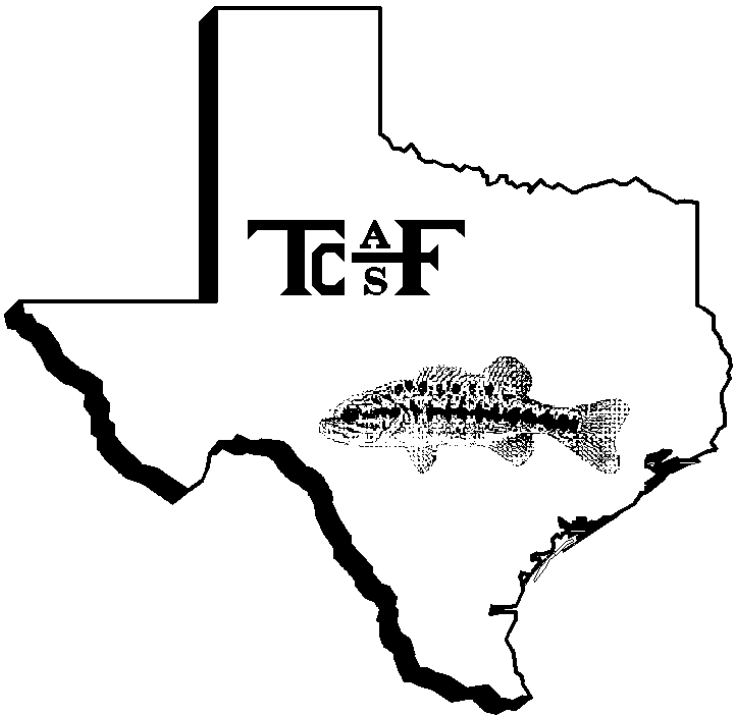
ANNUAL PROCEEDINGS
of the
TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY



Grapevine, Texas

21 – 23 January 2005

Volume 27

TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY

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

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

Texas Chapter, American Fisheries Society
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Texas Parks and Wildlife Department
4200 Smith School Road
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ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER AMERICAN FISHERIES SOCIETY

Annual Meeting
21-23 January 2005
Grapevine, Texas

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2006

Published by:
Texas Chapter, American Fisheries Society
c/o Texas Parks & Wildlife Department
4200 Smith School Rd
Austin, Texas 78744

TABLE OF CONTENTS

Abstracts of Posters Presented at the Annual Meeting but not Published in the Proceedings

Technical Papers Presented at the Annual Meeting and Peer-Reviewed for Publications

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 Texohoma, 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 Texohoma, 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

TEXAS CHAPTER AWARDS RECIPIENTS

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

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

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

1980 None

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

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

1983 Special Recognition - Robert Kemp (TPWD)

1984 None

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

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

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

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

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

Best Presentation - Robert Smith (TAMU)

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

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

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

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

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

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

1996 Fisheries Education - Billy Higginbothan (TAMU)
Fisheries Management - Gary Garrett (TPWD)
Fisheries Administration - Gene McCarty (TPWD)
Fisheries Research - Ivonne Blandon (TPWD)
Special Recognition - Reeves County Water Improvement Board
Best Presentation (s) - Craig Paukert (OSU), Gene Guilliland (ODWC)
Scholarships - Chad Thomas (TXSTATE), Anna-Claire Fernandez (UTMSI), Kenneth Ostrand (TTU), Dawn Lee Johnson
Technical Support - Jimmy Gonzales (TPWD)
Honorable Mention (technical support) - Eric Young (TPWD)

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

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

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

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

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

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

2004 Fisheries Culture - Lisa Griggs (TPWD)
Fisheries Education - Timothy Bonner (TXSTATE)
Fisheries Research - Dave Buckmeier (TPWD)
Fisheries Student - Casey Williams (TXSTATE)
Special Recognition - Deborah Wade (TPWD)

Best Presentation - Richard Kraus and David Secor (TAMUG)
Best Student Presentation - Tracy Leavy, coauthor Timothy Bonner (TXSTATE)
Best Poster Presentation - Brian Scott and Gary Aron (TXSTATE)

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

Abbreviations:

ACE - Army Corps of Engineers
NMFS - National Marine Fisheries Service
ODWC - Oklahoma Department of Wildlife Conservation
OSU - Oklahoma State University
SCS - Soil Conservation Service
SHSU - Sam Houston State University
TAES - Texas Agricultural Extension Service
TAMU - Texas A&M University
TAMUCC – Texas A&M University-Corpus Christi
TPWD - Texas Parks and Wildlife Department
TTU - Texas Tech University
TUGC - Texas Utilities Generating Company
TXSTATE - Texas State University-San Marcos
USFWS - US Fish and Wildlife Service
UT - University of Texas at Austin
UTMSI - University of Texas Marine Science Institute
UTPA - University of Texas/Pan American

TECHNICAL SESSION ABSTRACTS

Bioaccumulation of Mercury in Fish from Two Texas Lakes

William C. McClain *(Texas Christian University, Department of Biology, Fort Worth, Texas 76129, w.c.mcclain@tcu.edu)*
Mathew M. Chumchal *(University of Oklahoma, Department of Zoology, Norman, Oklahoma 73019, chumchal@ou.edu)*
Ray W. Drenner *(Texas Christian University, Department of Biology, Fort Worth, Texas 76129, r.drenner@tcu.edu)*
L. Newland *(Texas Christian University, Institute of Environmental Studies, TCU Box 298830 Fort Worth, TX 76129)*

We examined total mercury concentration in nine species of fish from Lake Meredith and fifteen species of fish from Caddo Lake, Texas. These two lakes are limnologically different, but both lakes have a consumption advisory. Total mercury concentration was determined in dorsal white muscle of 281 fish from Lake Meredith and 421 fish from Caddo Lake allowing us to look at different fish species across a large size gradient. Piscivores within each lake had the highest levels of mercury. Walleye, white bass, largemouth bass, drum, chain pickerel, spotted gar, warmouth, and flathead catfish had mercury concentrations exceeding 0.5 ppm and several flathead catfish, spotted gar, and largemouth bass had mercury concentrations exceeding 1.0 ppm. Mercury concentration was positively correlated with fish length and weight for all species except gizzard shad, which exhibited a negative correlation between mercury concentration and length and weight for both lakes. In addition, mercury concentration in some species exhibited a strong positive correlation with age.

Do Fish Advisories Accurately Convey Risk?: Effect of Small Sample Size and Species Specific Advisories

Mathew M. Chumchal *(University of Oklahoma, Department of Zoology, Norman, Oklahoma 73019, chumchal@ou.edu)*
K. David Hambright *(University of Oklahoma, Biological Station and Department of Zoology, Norman, Oklahoma 73019, dhambright@ou.edu)*
William C. McClain *(Texas Christian University, Department of Biology, Fort Worth, Texas 76129, w.c.mcclain@tcu.edu)*
Ray W. Drenner *(Texas Christian University, Department of Biology, Fort Worth, Texas 76129, r.drenner@tcu.edu)*
David Cross *(Texas Christian University, Department of Psychology, Fort Worth, Texas 76129, d.cross@tcu.edu)*

State health officials are responsible for issuing fish consumption advisories or bans. We examined the USEPA National Listing of Fish Advisories database and contacted state agencies to determine the procedures used by each state to issue fish advisories for mercury. Preliminary results indicate that states commonly sample small numbers of fish when issuing advisories and apply water body and species-specific advisories. We used fish collected from Lake Caddo and Lake Meredith, Texas, to determine the potential error associated with a small sample size and to compare the concentration of mercury in fish that have mercury advisories to those that do not have mercury advisories. Sampling a small number of fish increased the chance that an incorrect decision regarding the issuance of an advisory would be made but accuracy was improved by increasing sample size to a moderate level. Species of fish that do not have advisories did not necessarily have lower concentrations of mercury than species that do have advisories. We recommend that state agencies increase the number of fish they examine when determining whether to issue advisories and that state agencies work closely with fisheries managers to determine the sizes and species most likely to be consumed by fishermen.

Improving Angling Opportunities In Public Ponds Through Intra-Agency Collaboration

C. Craig Bonds *(Texas Parks and Wildlife Department, 505 Staples Rd, San Marcos, Texas 78666, craig.bonds@tpwd.state.tx.us)*
Stephan J. Magnelia *(Texas Parks and Wildlife Department, 505 Staples Rd, San Marcos, Texas 78666, stephan.magnelia@tpwd.state.tx.us)*

Two ponds (< 10 ha each), located entirely within state park boundaries, were manipulated using various fisheries improvement techniques to increase angling opportunities for park visitors. Improvement techniques included fish augmentation by stocking, water augmentation by pumping groundwater, adding agricultural limestone and liquid fertilizer, installing a water destratification system, implementing a restrictive length limit on largemouth bass, and applying bentonite clay to a leaky dam. These techniques were conducted utilizing collaborative efforts among a variety of Texas Parks and Wildlife Department staff and funding sources. We observed increases in electrofishing catch rates and size structures for bass and sunfish compared to samples collected prior to the initiation of improvement efforts. Our results suggest that public ponds (< 10 acres) offer small-scale environments which can respond quickly and significantly to fisheries improvement strategies and offer opportunities for collaborative teams to serve the angling public.

Economic Characteristics, Attitudes, and Management Preferences among Lake Amistad Anglers 2002-2003

Timothy Bradle *(Texas Parks and Wildlife Department, 4200 Smith School Rd, Austin, Texas 78744, timothy.bradle@tpwd.state.tx.us)*

Cooperative planning efforts between the Texas Parks & Wildlife Department, the National Park Service and the Secretary of Agriculture, Cattle, Rural Development, Fisheries and Nutrition of Mexico have recommended research to determine the economic and social characteristics, attitudes, opinions and preferences among Lake Amistad anglers. Impounding the Rio Grande, Pecos and Devils rivers, Lake Amistad contains over 65,000 surface acres and 850 miles of shoreline between Mexico and the United States. It is a popular fishing destination and an asset to the City of Del Rio's tourism industry. Between March 2002 and March 2003, survey instruments were distributed to 1,214 anglers during a random access point creel survey on randomly selected days at the reservoir. Survey topics included angler trip expenditures and values, participation, satisfaction, management preferences and attitudes regarding largemouth and striped bass quality, and demographics. Preliminary results indicate that Lake Amistad receives a larger proportion of anglers from outside of the local area, generating a substantial level of economic impact to the City of Del Rio and Val Verde County economy. Results of both economic and social characteristics among Lake Amistad anglers will be presented.

Fish Communities in Urban Settings: Multiple Hypotheses Testing of Fish Incidence Patterns

Christopher J. Chizinski *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 chris.chizinski@ttu.edu)*
Christopher Higgins *(Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409-3131 Chris.higgins@ttu.edu)*
Kevin Pope *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 kevin.pope@ttu.edu)*

Although humans are an integral part of virtually all ecosystems, ecological and evolutionary theories have traditionally focused on natural processes with little attempt to incorporate anthropogenic influences. We used a series of alternate models that incorporated anthropogenic factors and traditional ecological mechanisms of invasion to account for fish incidence patterns in urban lakes. The models were broadly based on fish biology, human intervention, and habitat characteristics. The only models to account for empirical patterns were those that included fish invasiveness, which incorporated species-specific information about overall tolerance and fecundity. This suggests that species-specific characteristics are more important in general distributional patterns than human-mediated dispersal, at least within an urban center. Better information of illegal activities is needed to

improve human-mediated models, and more insight into basic life history of ubiquitous species is needed in order to truly understand underlying mechanisms of biotic homogenization.

Texas Fish Recovery Plan Goals and the Lake Livingston Example

Greg Conley *(Texas Parks and Wildlife Department, 11942 FM 848, Tyler, Texas 75707, greg.conley@tpwd.state.tx.us)*
Joan Glass *(Texas Parks and Wildlife Department, 1601 E. Crest Dr., Waco, Texas 76705, joan.glass@tpwd.state.tx.us)*

Fish Recovery Plans are needed for any human activity that would cause harm to or the death of fishes of the State of Texas. The primary purpose of a fish recovery plan is to eliminate or reduce the impacts of the activity upon fish populations. The Texas Parks and Wildlife Code and the Texas Water Code authorize restitution for losses of state assets, investigation costs, and administration costs. The Inland Fisheries Kills and Spills Team, together with the Regional Fisheries Management and Game Warden offices, review and approve the Fish Recovery Plans and monitor the performance of the plan's operations. The dewatering of the Lake Livingston weir wall area below the dam in July 2004 is one example of the complex issues in the building of the plan. This area is a major striped bass fishery in Texas and has been the main source of striped bass brood stock for the Texas Parks and Wildlife Department since 1981. Overcoming the obstacles presented by this fish recovery effort required cooperation from several agencies.

The Upper and Lower Thermal Tolerances of Wildtype and Transgenic Zebra Danios *Danio rerio*

Cheryl Cortemeglia *(University of North Texas, Department of Biological Sciences, P.O. Box 5218, Denton, TX, 76201, cc0115@unt.edu)*
Thomas L. Beitinger *(University of North Texas, Department of Biological Sciences, P.O. Box 5218, Denton, TX, 76201, beitingr@unt.edu)*

The introduction of nonnative species has been implicated in the decline and extinction of native species. The effects to ecosystems by genetically modified organisms are still unknown, yet a transgenic pet (the red glofish or red fluorescent protein transgenic zebra danio) is currently being sold throughout the USA. We quantified the temperature tolerance of over 150 wildtype and red transgenic zebra danios *Danio rerio* via the critical thermal method to determine the overwintering potential of this species in U.S. waters. Red glofish and wildtype zebra danios acclimated to 20°C and 30°C had critical thermal maxima ($\pm$ SD) ranging from 38.8$\pm$0.54°C to 41.7$\pm$0.35°C. The critical thermal minima ($\pm$ SD) ranged from 6.2$\pm$0.28°C to 10.6$\pm$0.53°C. At both acclimation temperatures, CTMinima and CTMaxima were significantly different between the two varieties; however, differences were 1°C and less. The temperature tolerances of both varieties of zebra danios are strongly influenced by acclimation temperature, can be classified as eurythermal, and are in the relatively rare category of fishes with a measured mean CTMaxima above 40.0°C. A comparison of these data to similar data reported for tropical exotic fishes established in U.S. waters suggest that both zebra danio varieties are capable of overwintering in some U.S. waters.

The International Grand Isle Tarpon Rodeo: Trends in the Recreational Tarpon *Megalops atlanticus* Fishery in the Western Gulf of Mexico

William Dailey *(Texas A&M University – Galveston, 5007 Avenue U, Galveston, TX 77551, daileyw@tamug.edu)*
André M. Landrey, Jr. *(Texas A&M University – Galveston, 5007 Avenue U, Galveston, TX 77551, landrya@tamug.edu)*
Steve Hein *(Louisiana Department of Wildlife and Fisheries, Bourg, LA 70343, shein@wlf.louisiana.gov)*

Anecdotal evidence suggests tarpon populations in Texas and western Gulf of Mexico have declined since the 1960s; however, quantifying this decline is complicated by a lack of landings data, both number of fish and tonnage. In contrast, silver king landings at Louisiana's most renown fishing tournament, the International Grand Isle Tarpon Rodeo, are well documented during this period and tend to contradict anecdotal evidence. A

93.4 kg (206 lb.) tarpon landed in 1973 holds the record for the more than eighty year-old rodeo. Only three other tarpon in excess of 90 kg have been entered since 1957; one in 2001 and two in 2002. Mean weight of winning entries during 1957 - 1973, 1974 - 1992, and 1993 - 2003 was 61.3 ± 7.60, 77.9 ± 7.11 and 81.2 ± 7.05 kg (mean ± SD), respectively, with these weights differing significantly ($F_{2,41} = 32.64$, $p < 0.01$). The 691 tarpon landed or leadered at Grand Isle during the three aforementioned intervals were comprised of 309, 279, and 103 individuals, respectively. Mean annual number of entries (landed or leadered) during these time intervals was 18.2 ± 12.9, 14.7 ± 7.66 and 9.36 ± 9.73, respectively. Analysis of variance indicated no significant statistical difference in number of entries for the three time intervals. Entries in the Grand Isle tarpon rodeo contradict anecdotal evidence related to a collapse in the western Gulf silver king fishery with trophy tarpon being captured and a statistically insignificant decline in number of tournament entries.

Fish Population Changes in the Lower Canyons of the Rio Grande: 1977-2003

Robert J. Edwards *(Department of Biology, University of Texas-Pan American, Edinburg, Texas 78541, redwards@panam.edu)*
Gary P. Garrett *(Texas Parks and Wildlife Department , Heart of the Hills Fisheries Science Center, Ingram, Texas 78025, Gary.Garrett@tpwd.state.tx.us)*

The Lower Canyons of the Rio Grande, part of America's Wild and Scenic Rivers Program, have not remained pristine and suffer from environmental degradation that has impacted fish populations and their distributions. Fishes such as speckled chub *Macrhybopsis aestivalis*, Rio Grande shiner *Notropis jemezanus*, longnose dace *Rhinichthys cataractae* and blue sucker *Cycleptus elongatus* appear to have suffered recent declines. Although water quantity appears to be an important factor, related changes in channel morphology brought on by massive stands of giant reed *Arundo donax* and salt cedar *Tamarix* sp. may also be responsible. These invasive exotics have essentially channelized the river, disrupted normal sediment distribution and reduced shallow, low-velocity habitats. Much of this section of river is devoid of sandy sediments and most riffles are now composed of gravel and cobble.

Morphology, Merisitic Counts, and Pigmentation of *Dionda diaboli* (Cyprinidae) During Development

Julie Hulbert *(Texas State University, 601 University Dr., San Marcos, TX 78666, jh1308@txstate.edu)*
Tim Bonner *(Texas State University, 601 University Dr., San Marcos, TX 78666, tbonner@txstate.edu)*
Joe Fries *(National Fish Hatchery and Technology Center, McCarty Lane, San Marcos, TX 78666, Joe_Fries@fws.gov)*

Morphometrics and meristic characteristics of the Devils River minnow *Dionda diaboli* was described from time of hatch until 128 days old to facilitate identification of larval and juvenile fish. Five groups of approximately 300 fish each were reared at the San Marcos National Fish Hatchery and Technology Center. Five individuals from each group were captured, anesthetized, and preserved in 10% formalin on Day 2, 4, 8, 16, 32, 64, and 128. Mophometric measures included postorbital, head, depressed anal and dorsal fin, caudal peduncle, pelvic fin, and pectoral fin lengths, standardized by standard length. Meristic counts included preanal, postanal, and total myomere counts, and caudal, dorsal, anal, and pelvic fin rays counts. In addition, timing and occurrence of coloration known to distinguish adult *D. diaboli* from congeners were described. Myomere counts, pectoral fin length, orbital length, and body depth were assessed as early as 2 days post-hatch in protolarval fish. In protolarval fish at 4 days post-hatch, postorbital length, head length, and caudal peduncle depth also were noted. Dorsal and anal fins appeared in late mesolarval or early metalarval stages, by 32 days post-hatch, and pelvic fins were apparent in metalarvae between 32 and 64 days post-hatch. Caudal fin ray counts were made at Day 16 post-hatch, and dorsal, anal, and pelvic fin ray counts were recorded on Day 32 and 64 post-hatch. Caudal spots were apparent at 32 days post-hatch, and wedged shape caudal spots appeared in 19% of metalarval fish at Day 64 post-hatch. In juvenile fish Day 64 to 128 post-hatch, wedge-shaped caudal spots were apparent in 92% of fish, scale borders were present in 66% of fish, and double dashes along the lateral line were visible in 89% of fish. The intestinal shape of adult *Dionda diaboli* is more convoluted than that of other cyprinid genera, such as *Notropis*. It consists of three or four loops over a simple S-shape, and this pattern is apparent in late metalarvae and also juvenile fish, Day 64 and 128 post-hatch.

Catch-and-Release Mortality of Spotted Seatrout *Cynoscion nebulosus*

Jason T. Jones *(Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, jtjames1970@hotmail.com)*
Gregory W. Stunz *(Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, greg.stunz@mail.tamucc.edu)*
David A. McKee *(Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, dmckee@falcon.tamucc.edu)*

The spotted seatrout *Cynoscion nebulosus* is one of the most sought after marine sport fish in Texas and the Gulf Coast. The popularity of spotted seatrout in Texas correlates into economic gain for many coastal communities and state-wide. Despite the benefits created by the fishery, increasing fishing pressure has raised concerns over its sustainability. As a result, management regulations dependent upon the release and post-capture survival of spotted seatrout have been modified. This study examines mortality associated with hook-and-line captured spotted seatrout by recreational anglers as a function of season and anatomical hooking location and in live-release tournaments. From July to November 2004, 266 spotted seatrout ranging from 220 – 555 mm were captured on hook-and-line in Aransas and Corpus Christi Bays and maintained in field enclosures (3.5 m^3) for 72 hours. A higher mortality rate was found in summer (10%) than fall (0%). Anatomical hooking location was a major factor influencing mortality. Fish hooked in the esophagus and gills had mortality rates of 94% and 50%, whereas fish hooked in the mouth and externally had mortality rates of 14% and 0%, respectively. From February to May 2004, 660 spotted seatrout were captured in four live-release tournaments. Overall tournament mortality was 29% with initial and delayed mortality rates of 17% and 15%, respectively. These data suggest that current catch-and-release management regulations for spotted seatrout are a viable management strategy.

Can Invasiveness of Native Species Be Predicted by Life History Traits?

Brad Littrell *(Texas State University, 601 University Dr., San Marcos, TX 78666, bl59931@txstate.edu)*
Tim Bonner *(Texas State University, 601 University Dr., San Marcos, TX 78666, tbonner@txstate.edu)*

Anthropogenic alterations to stream environments generally lead to a decrease in occurrence and abundance of native fishes, and successful establishment and increase in occurrence and abundance of non-native fishes, causing a reduction of global biodiversity and extirpations of distinct and local faunas. Under some circumstances however, anthropogenic alterations will improve conditions for certain native fishes that subsequently become more abundant, thus altering biotic interactions and affecting occurrence and abundance of other native taxa. This study tests the hypothesis that common, overabundant native fishes, relative to endemic forms, exhibit life history characteristics similar to highly invasive exotic species by comparing life history attributes (e.g., habitat selection, reproduction, growth, longevity, and diet) between a species known to increase in abundance after alterations (blacktail shiner *Cyprinella venusta*), and a regionally endemic species (Texas shiner *Notropis amabilis*) in a central Texas stream. Results indicate that *C. venusta* exhibits a more ubiquitous distribution among habitats, invests more energy into reproduction, and has a larger size and longer life span when compared to *N. amabilis*. Collectively, life history attributes of the native invader (*C. venusta*) were similar to those of successful exotic invaders and likely indicate why some native fishes are more successful than others in persisting in modified aquatic systems.

Identification of Nursery Habitat for Juvenile Southern Flounder *Paralichthys lethostigma* in Aransas Bay, Texas

Suraida Nañez-James *(Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, idajay21@hotmail.com)*
Gregory W. Stunz *(Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, greg.stunz@mail.tamucc.edu)*
Scott Holt *(The University of Texas at Austin, Marine Science Institute, 750 Channel View Drive, Port Aransas, Texas 78373, sholt@utmsi.utexas.edu)*
Jay Rooker *(Texas A&M University – Galveston, P.O. Box 1675, Galveston, Texas 77553, rookerj@tamug.edu)*

Southern flounder *Paralichthys lethostigma* populations in Texas have been in steady decline. Despite the economic importance of this species, little is known about their juvenile habitat requirements in the Gulf of Mexico. The goal of this project was to determine the temporal and spatial patterns of juvenile southern flounder habitat use. Sampling was conducted from January through July 2004 in the Aransas/Copano estuaries in Texas. The bay complex was divided into three zones from near the tidal inlet to the fresh headwaters of a tertiary bay. A beam trawl was used to sample in three areas within each zone in three different habitat types: seagrass *Halodule wrightii*, marsh *Spartina alterniflora*, and open water (nonvegetated). Flounder showed distinct habitat use patterns with significantly higher densities occurring in marsh and seagrass. Few flounder were collected over open bay bottom. We observed spatial and temporal trends in flounder densities in relation to distances from the tidal inlet. No flounder were captured in the tertiary bay sampling zone. We plan to increase sampling frequency during 2005 to further examine density patterns throughout the bay system. Results from this study will provide needed data on juvenile habitat use patterns of newly settled southern flounder.

Origins of Red Drum Stocks: Assessing the Contribution of Different Nursery Grounds Using Chemical Signatures

Gregory W. *Stunz (Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, Texas 78412, greg.stunz@tamucc.edu)*
Jay Rooker *(Texas A&M University – Galveston, 5700 Ave U, Galveston, Texas 77551, rookerj@tamug.tamu.edu)*
Joan Holt *(The University of Texas at Austin, Port Aransas,Texas, 78373, joan@utmsi.utexas.edu)*
Scott Holt *(The University of Texas at Austin, Port Aransas,Texas, 78373, sholt@utmsi.utexas.edu)*

The aim of this study is to use natural markers in otoliths (trace elements and stable isotopes) to determine the nursery origin of red drum *Sciaenops ocellatus*. In 2001-2003, age-0 red drum were sampled from nurseries in Texas: Sabine Pass, East Bay-Galveston, West Bay-Galveston, Matagorda Bay, Copano Bay, Aransas Bay, and the lower Laguna Madre. Stable isotopes [delta super(13)C, delta super(18)O] and trace elements (Mg, Ca, Mn, Cu, Sr and Ba) were quantified in the otoliths, and ratios differed significantly among estuaries and within-site variability was relatively low. North-to-south gradients were observed for delta super(13)C and delta super(18)O, and both isotopes were enriched in otoliths of red drum from southern sites relative to northern sites. Correct assignment to a specific estuary based on stable isotopes ratios alone was greater than 80% in each year. Classification success was further improved (90%) when a single trace element (Sr) was added to the model. To establish the nursery origin of adult red drum, stable isotope and trace element values in the core must be determined. The analysis of these cores is currently underway, and these data will be used to predict the contribution of different nursery grounds to adult red drum stocks in Texas.

Status of the Blue Crab *Callinectes sapidus* in Texas Coastal Waters with Research Recommendations

Glen Sutton *(Texas Parks and Wildlife Department, 1502 F.M. 517 E, Dickinson, Texas 77539, Glen.Sutton@tpwd.state.tx.us)*
Tom Wagner *(Texas Parks and Wildlife Department, 702 Navigation Circle, Rockport, Texas 78382, Tom.Wagner@tpwd.state.tx.us)*

The blue crab fishery is the fourth largest commercial saltwater fishery in Texas, accounting for 5% of total landings and 1% of total ex-vessel value in 2000. Data from Texas Parks and Wildlife Department's fishery-independent and fishery-dependent monitoring programs, as well as applicable special studies, were evaluated to determine the status of blue crab populations. Catch-per-unit-effort (CPUE) and mean carapace width of blue crab have declined over time in bag seine and trawl samples. Commercial landings of hard crabs have declined since 1987, as has catch-per-unit-effort. Total mortality of blue crabs, determined by Hoenig's length-based methodology, ranged from 1.0-1.2 from 1995-2003, with no apparent trend. Causes for declining populations include habitat loss, shrimp trawl bycatch, and possible growth-overfishing. Current management measures in place to address fishery problems, such as effort and license limitation, are discussed. Specific research recommendations needed for effective crab fishery management in Texas are included.

Increases in Voluntary Release Rate of Largemouth Bass of Legally-Harvestable Size from Texas Creel Surveys Over 1985-1999

John Barry Taylor *(Texas Parks and Wildife Department, 4200 Smith School Road, Austin, TX 78745, John.Taylor@tpwd.state.tx.us)*
Randall A. Myers *(Texas Parks and Wildife Department, 2122 Old Henderson Highway, Tyler, TX 75702, Randy.Myers@tpwd.state.tx.us)*

Concurrent with a large increase of popular interest in bass angling over the past few decades, anecdotal evidence indicates a strong catch-and-release ethic has also become more prevalent among largemouth bass (LMB) anglers. However, documentation of long-term changes in LMB voluntary release rates is lacking. Texas Parks and Wildlife conducted annual creels on five reservoirs managed with minimum-length limits for LMB (Canyon, Conroe, Palestine, Sam Rayburn ,and Toledo Bend) and two managed with protected slot limits (Lake Fork and Monticello) over varying time spans of 12-15 years from 1985-99. Voluntary release rates of LMB in legally-harvestable sizes increased significantly over time in each of the seven reservoirs, with correlation coefficients ranging from 0.62-0.96. Analysis of covariance indicated the slope of the relationship between voluntary release rate and time for Lake Fork to be significantly lower than for the other six reservoirs, and Lake Fork also had the highest voluntary release rates observed. Lake Fork has had a reputation as an exceptional fishery for trophy bass since the mid-80s, and anglers there have consistently demonstrated a high propensity to voluntarily release LMB of harvestable size. By 1999, voluntary release rates ranged from 52-98% in creels from all reservoirs examined.

Effects of Flooding on Fish Habitat Selection in a West Texas Stream

Jackie Watson *(Texas State University, 601 University Dr., San Marcos, TX 78666, jw43957@txstate.edu)*
Tim Bonner *(Texas State University, 601 University Dr., San Marcos, TX 78666, tbonner@txstate.edu)*

Independence Creek is the largest freshwater contributor to the lower Pecos River and supports a diverse fish assemblage, including two state-listed threatened species (*Cyprinella proserpina, Etheostoma grahami*), two state-listed species of special concern (*Ictalurus lupus, Notropis jemezanus*), and two regionally endemic species (*Dionda episcopa, Notropis amabilis*). This fish assemblage is adapted to flashy stream flows. In July of 2004 a large flood event (estimated 80,000 cubic feet per second) occurred in Independence Creek. We sampled ten days and two months after this flood event. Using two years of pre-flood fish assemblage data we examined the effect of this high flow event on the fishes of Independence Creek. We assessed habitat associations of dominant taxa pre- and post-flood among stream reaches using canonical correspondence analysis (CCA) and univariate analyses. Results showed a large shift in habitat associations as expected due to the homogenization of available

habitat in the creek. Although habitat associations shifted, multivariate segregation of the dominant species remained similar between pre- and post-flood data.

Effect of Hook Removal on Recapture Rates of Angler-Caught Australian Fishes

Gene R. Wilde *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, gene.wilde@ttu.edu)*
William Sawynok *(Infofish Services, 142 Venables St., North Rockhampton, Queensland, Australia 4701, infofish@zbcom.net)*

We used data from a cooperative angler tagging program to assess the potential benefit of leaving hooks in fish captured and released by anglers. We assembled 248,010 records for 27 species of Australian fishes. Hooks were left in only 1.1% of released fish and the overall recapture rate was 8.8%. We used relative risk, the probability of an event (recapture) in a treatment group (those with hooks not removed) divided by the probability of an event in a control group (those with the hook removed), to assess the potential effects of leaving hooks in released fish. Relative risk ranged from 0.30 to 7.6, but did not differ significantly from 1.0 in any species. Thus, there was no evidence that hook removal affected recapture probability. Pooling results across all species yielded an overall relative risk of 1.18 (95% confidence interval, 1.02 to 1.36), which suggests that the recapture rate of fish in which hooks were not removed prior to release was marginally greater than that for fish released without hooks. Our results indicate there is no substantial benefit, nor adverse affect, of hook removal on recapture rates, which can be considered as a surrogate measure of survival of released fish.

Trends in Atlantic Croaker Populations Using Coastal Fisheries Monitoring Data

Leslie Williams *(Texas Parks and Wildlife Department, 1502 FM 517 East, Dickinson, TX 77539, leslie.williams@tpwd.state.tx.us)*
Glen Sutton *(Texas Parks and Wildlife Department, 1502 FM 517 East, Dickinson, TX 77539, glen.sutton@tpwd.state.tx.us)*

Atlantic croaker *Micropogonias undulatus* is an important estuarine species in Texas that is impacted by environmental factors and recreational and commercial fishing pressure. This species currently has no regulations for recreational catches, but Texas has been monitoring croaker because they are caught in high numbers in shrimp trawls as bycatch. The status of croaker in Texas and the effects of a limited entry program for bay shrimpers, initiated in 1995, were assessed using Texas Parks and Wildlife Coastal Fisheries standardized monitoring programs. Coastal Fisheries has conducted standardized dependent and independent sampling since the mid 1970's. Dependent monitoring includes recreational and commercial landings that include self-reporting by anglers and bait and seafood dealers. Independent sampling is conducted using bag seines, trawls and gill nets. The data is used to examine catch per unit effort (CPUE) and size structure of the population. Commercial landings showed a significantly larger number of croaker sold as bait at an increased value since 1993 while recreational landings have significantly decreased since 1983. Coastwide estimates from the independent data failed to reveal any significant trends in CPUE or average fish length. There is no evidence that the limited entry program has had any significant impact on croaker populations.

Texas Harmful Algal Bloom (HAB) Workgroup

Meridith Byrd *(Texas Parks and Wildlife Department, 3000 South IH-35 Suite 320, Austin, TX 78704 meridith.byrd@tpwd.state.tx.us)*

The Texas Harmful Algal Bloom (TexHAB) Workgroup is a subcommittee of the legislatively-mandated Toxic Substances Coordinating Committee. Its goals include improving understanding of Texas HABs and facilitating cooperation between members, including academic researchers, federal/state/local agency staff, media, chambers of commerce and the like. Quarterly meetings are held to discuss topics such as current blooms, research and funding opportunities, and an e-mail distribution list keeps members updated between meetings. Texas' most well known HABs, red tide *Karenia brevis* and golden alga *Prymnesium parvum*, are major areas of interest. Both algae cause widespread fish kills and receive a large amount of press coverage due to their impacts

on recreation. Future projects for the workgroup include the creation of a red tide information card and the formation of a volunteer HAB monitoring program along the coast. TCAFS members are invited to join if interested.

BASS SYMPOSIUM ABSTRACTS

Working Together to Improve Bass Management in Texas

Tim Cook *(Texas BASS Federation, State Conservation Director, 319 Pecan Dr. NE, McQueeney, Texas 78123, MrBass@sanmarcos.net http://www.texas-bass.com/cons)*

Conflicts often arise between anglers and resource managers from a misunderstanding of each other's point of view. The first step in solving any conflict is to bring the groups together and discuss different perspectives in order to promote mutual understanding. If the ultimate goal of each group is similar, mutual collaboration can yield greater results than independent efforts. It is my opinion that most anglers and resource managers share similar goals regarding bass management in Texas. I argue that the lack of interaction between resource managers, researchers and anglers is the cause of many conflicts and increases the difficulty associated with solving problems. Simply encouraging resource managers to take advantage of angling opportunities and inviting anglers to management symposiums and to assist in special projects, will result in a much greater level of mutual respect and understanding. In addition, angling groups and resource managers need to identify programs on which we can work together to achieve more beneficial results. The Texas BASS Federation provides several examples of how this can be accomplished.

Annual Exploitation of Largemouth Bass at Sam Rayburn Reservoir: Incorporating the Tournament-Related Mortality Component

M. Todd Driscoll *(Texas Parks and Wildlife Department, Rt. 2 Box 535, Jasper, TX 75951, todd.driscoll@tpwd.state.tx.us)*
Jules L. Smith *(Texas Parks and Wildlife Department, Rt. 2 Box 535, Jasper, TX 75951, jay.smith2@tpwd.state.tx.us)*

The largemouth bass *Micropterus salmoides* fishery at Sam Rayburn Reservoir is managed with a 356-mm minimum length limit (MLL) and is popular with tournament anglers. An estimated 52% of Sam Rayburn anglers participate in tournaments and the annual number of events likely exceeds 300. In 2001, 47% of anglers favored more restrictive largemouth bass length limits, assuming a resulting increase of fish > 457 mm. In 2003, 6,021 largemouth bass > 315 mm were tagged to 1) estimate annual largemouth bass exploitation and account for fishing mortality sources due to non-tournament angler harvest, tournament angling, and the practice of catch and release, 2) explore potential benefits of more restrictive length limits via population modeling, and 3) evaluate effects of tournament mortality on annual exploitation. Catch and harvest of tagged fish by tournament and non-tournament anglers was estimated via creel sampling to avoid non-reporting uncertainty and adjusted for recruitment and tag loss. Actual fish deaths associated with catch and release and tournament angling were simulated using mortality rate ranges of 5 – 15% and 10 – 50%, respectively. Simulations indicated annual deaths associated with both catch and release and tournament angling ranged from 1 – 6% of the population and adjusted total annual exploitation ranged from 9 – 24%. Compared to the current 356-mm MLL, population modeling indicates 406-mm and 457-mm MLLs provide only slight increases of fish reaching 457 mm (1 – 4% and 3 – 11%, respectively). Although tournament angling is popular and frequent at Sam Rayburn Reservoir, our results indicate negligible tournament-related population-level impacts. A more restrictive MLL would reduce tournament catch available for weigh-in and provide little overall fishery benefit compared to the current regulation.

Evaluation of a Largemouth Bass Tournament Monitoring Program at Sam Rayburn Reservoir

M. Todd Driscoll *(Texas Parks and Wildlife Department, Rt. 2 Box 535, Jasper, TX 75951, todd.driscoll@tpwd.state.tx.us)*

In June 2003, I implemented an annual largemouth bass tournament-monitoring program at Sam Rayburn Reservoir to supplement population information collected from electrofishing and creel surveys. Program utility was evaluated by examining tournament organization participation and comparing costs/man-hours associated with similar data from electrofishing and creel surveys. Of the 107 bass tournament organizations identified, 51 were contacted regarding program participation, and only one organization declined. Only 25 provided data, which included 13 whose results I manually retrieved via websites. Twelve organizations entered data into the web-based entry form as requested, but only three provided data for more than one tournament. A total of 12,388 fish $\geq$ 14 inches total length, 53 fish $\geq$ 5 pounds, and 41 fish $\geq$ 8 pounds were entered into the program via 54 man-hours and a cost of < $50. A total of 122, 5, and 1 fish and 4,011, 40, and 12 fish of similar sizes were collected from electrofishing (72 man-hours; $196 cost) and creel surveys (1,500 man-hours; $7,500 cost), respectively. Only results from organizations with web-based results will be used in future years, as they accounted for 75% of fish entered into the program via 14 man-hours and no associated costs.

Operation World Record: a Cooperative Trophy Largemouth Bass Program

Allen Forshage *(Texas Parks and Wildlife Department, Texas Freshwater Fisheries Center, 5550 FM 2495, Athens, Texas 75751 allen.forshage@tpwd.state.tx.us)*
Dijar J. Lutz-Carrillo *(Texas Parks and Wildlife Department, A. E. Wood Fish Hatchery, 507 Staples Road, San Marcos, Texas 78666 dijar.lutz-carrillo@tpwd.state.tx.us)*
Loraine T. Fries *(Texas Parks and Wildlife Department, A. E. Wood Fish Hatchery, 507 Staples Road, San Marcos, Texas 78666 loraine.fries@tpwd.state.tx.us)*

The Budweiser ShareLunker (SL) is a cooperative program sponsored by Anheuser-Busch, the Texas Parks and Wildlife Foundation, and the Texas Parks and Wildlife Department (TPWD) to encourage anglers to loan largemouth bass weighing at least 5.9 kg to the TPWD for research, spawning, and public relations/education purposes. Since the program's inception in 1986 through October 2004, a total of 355 anglers have provided 367 fish to the program. In 1999, TPWD implemented Operation World Record (OWR) as part of the SL program with the ultimate goal of producing world record largemouth bass in Texas. Operation World Record incorporates a selective breeding plan and long-term performance evaluations along with genetic assessments of fish produced through the program. Integral to OWR is the development of genetic markers to determine the sub-specific status of individuals and parental contributions to offspring. Based on this need, two classes of genetic markers, microsatellite DNA and members of the olfactory receptor pseudogene family, have been developed in our lab. Additionally, amplified fragment length polymorphisms are being explored for their utility in identifying quantitative traits useful in the selective breeding program.

Bass 101 Symposium

Billy Higginbotham, *(Texas Cooperative Extension, PO Box 38, Overton, TX 75684, bhigginbotham@tamu.edu)*

With over one million ponds comprising some one-half million acres, Texas landowners have numerous aquatic resources to manage for recreational fishing. Interest in managing these smaller impoundments for largemouth bass is high. In order to provide intensive management information on largemouth bass, a two day program entitled "Bass 101" was conducted in conjunction with the Hays County Extension office, Texas Parks and Wildlife, Natural Resources Conservation Service and the City of San Marcos. A similar symposium was conducted in 2001 in Athens, TX. The workshop was an unequivocal success. Surveys indicated that 80% of the 190 participants were pondowners. Forty-four percent indicated that aquatic weed management was their biggest problem, followed by poor fishing (17%) and water quality (7%). Interestingly, 20% said they would spend $50/acre to improve fishing, another 24% would spend $50-$100/acre, another 17% would spend $100-$250/acre,

another 19% would spend $250-$500/acre, another 7% would spend $500-$1,000/acre and 13% would spend over $1,000/acre. Pre and post tests revealed that participants increased their knowledge by 65%. A third Bass 101 Symposium is planned in Conroe on March 19, 2005.

Twenty-Four Years of Restrictive Largemouth Bass Length Limit Regulations on a Power Cooling Reservoir in Central Texas

Stephan J. Magnelia *(Texas Parks and Wildlife Department, 505 Staples Road, San Marcos, TX 78666 stephan.magnelia@tpwd.state.tx.us)*
C. Craig Bonds *(Texas Parks and Wildlife Department, 505 Staples Road, San Marcos, TX 78666 craig.bonds@tpwd.state.tx.us)*

Fayette County Reservoir is a 2,400-acre power cooling reservoir located in Central Texas. It has one of the state's best quality-size (14-21 inches) largemouth bass fisheries. The Texas Parks and Wildlife Department's Inland Fisheries Division has intensively managed the largemouth bass population on this reservoir since it opened for fishing in 1979. Management efforts have often included length and bag limit changes in response to angler concerns for maintaining fishing quality over the long term or improving trophy bass potential. This presentation will provide a case history of those management efforts. Minimum and slot-length limits have been used to increase and/or maintain the quality of the largemouth bass fishery. The reservoir opened under a 16-inch minimum length limit. Since 1985, three different slot-length limits have been used. As successive length limits became more restrictive, CPUE-14, PSD and RSD-14 from electrofishing increased. Relative weight and growth rates have also increased, which may be related to a decreasing trend in aquatic vegetation coverage. Directed fishing effort for largemouth bass has been high, averaging 35 hours/acre during spring creel surveys. Catch-and-release has also been high, comprising 81% of the catch under the 16-inch minimum length limit and 99% under the latest slot-length limit. Despite intense fishing pressure and minimal harvest, restrictive length limits have been effective in maintaining a high quality largemouth bass population in Fayette County Reservoir for 24 years.

Factors Related to Angler Catch of Trophy Largemouth Bass in Texas Reservoirs

Randall A. Myers *(Texas Parks and Wildlife Department, 2122 Old Henderson Highway, Tyler, Texas 75702, randy.myers@tpwd.state.tx.us)*
Michael S. Allen *(Department of Fisheries and Aquatic Sciences, The University of Florida, 7922 NW 71st Street, Gainesville, Florida 32653, msal@ufl.edu)*

We used angler catch reports of largemouth bass *Micropterus salmoides* from Texas Parks and Wildlife Department angler recognition programs to determine if catch occurrence of trophy fish ($\geq$5.9 kg) was greater in reservoirs stocked with fingerling Florida largemouth bass *M. s. floridanus* (FLMB) than in non-stocked reservoirs. We also compared trophy fish catch occurrence between reservoirs having the standard 356-mm minimum length harvest limit to reservoirs having a more restrictive length limit, and evaluated the relation of catch occurrence to reservoir age, surface area, shoreline development index (SDI), latitude, longitude, FLMB stocking frequency and density. Catch occurrence of trophy fish was significantly greater in FLMB-stocked reservoirs (29%) than in non-stocked reservoirs (4%). Probability of trophy largemouth bass catch occurrence in FLMB-stocked reservoirs increased with reservoir SDI, decreased with reservoir age, and was greater for reservoirs managed with special harvest regulations (high minimum length, protective slot, and catch-and-release-only restrictions) than for reservoirs managed with the statewide standard minimum size. Our study indicated that introduction of FLMB into Texas reservoirs yielded greater trophy largemouth bass potential and suggested that differences in trophy potential among FLMB-stocked reservoirs are likely more a function of differing reservoir habitat than differences in FLMB stocking frequency and density.

Use of an Angler Incentive Program for Data Collection and Management of a Trophy Bass Fishery

Michael J. Ryan, *(Texas Parks and Wildlife Department, 3802 East End Blvd. S., Marshall, TX 75672, michael.ryan@tpwd.state.tx.us)*
Michael W. Brice, *(Texas Parks and Wildlife Department, 3802 East End Blvd. S., Marshall, TX 75672, michael.brice@tpwd.state.tx.us)*
Loraine Fries, *(Texas Parks and Wildlife Department, A. E. Wood Fish Hatchery, 507 Staples Rd., San Marcos, TX 78666 loraine.fries@tpwd.state.tx.us)*

One hundred and seventy-six trophy-size ($\geq$ 3.6 kg) largemouth bass *Micropterus salmoides*, entered into a privately-sponsored catch-and-release program at Caddo Lake, Texas/Louisiana, were tagged and monitored to assess angler recapture rates, genetic composition, and their distribution within the lake. All largemouth bass program entries were scanned for tags to determine angler recapture rates over a 4-year period. Blood samples were obtained from initial entries and used to determine genetic composition using random amplified polymorphic DNA testing. Genetic data were used to evaluate the success of past stocking activities. Angler-reported catch locations were used to examine temporal and spatial distribution of initial and recaptured largemouth bass entries. Most (77.2%) of the largemouth bass entries were caught during March (46.9%) and April (30.3%). Twenty-three (13.1%) of the 176 largemouth bass were recaptured at least once and 4 (2.3%) were recaptured twice. The distance between initial and recapture locations ranged from 0.0 to 7.45 km (μ = 2.8 km) and corresponding time intervals between catches for individual fish ranged from 8 to 1,059 days (μ = 281 days) for all tagged fish returns (N = 27). Estimated genotypic composition of the entries was 15.5% Florida largemouth bass *M. s. floridanus*, 45.1% F_1 first generation hybrids, and 39.4% F_x non-first generation hybrids, indicating successful Florida gene introgression following stocking activities that occurred 15 years earlier. Most (85%) of the initial and recaptured largemouth bass entries were caught in the middle portion of Caddo Lake, suggesting habitat associations possibly related to the avoidance of oxygen-deficient areas in the lake and/or homing tendencies. Our results indicate this angler incentive program was highly utilized and trophy largemouth bass were recycled. Compared to electrofishing, the program provided a more efficient means for gathering genetic and catch distribution information on trophy-size largemouth bass.

The Lake Fork Trophy Bass Survey

Kevin Storey, *(Texas Parks and Wildlife Department, 2122 Old Henderson Hwy, Tyler, TX 75702, kevin.storey@tpwd.state.tx.us)*

The Lake Fork Trophy Bass Survey, a joint project of the Lake Fork Chamber of Commerce, the Lake Fork Sportsman's Association and the Texas Parks and Wildlife Department (TPWD), has enabled anglers to report catches of largemouth bass 7 pounds and heavier since March 2003. This unique project has provided TPWD with a mechanism to take a closer look at this nationally-recognized largemouth bass fishery and given anglers an opportunity to provide invaluable information to fisheries managers. Data on trophy fish is rare in standard fisheries management surveys. This project was specially designed to harness the cooperative efforts of anglers through a volunteer reporting program and enabled TPWD Inland Fisheries staff to get a more comprehensive view of the fishery. The survey has provided managers with another technique to help evaluate current management programs. This project has provided opportunities to build cooperative working relationships between sponsoring organizations, area businesses, fishing guides, and general anglers at Lake Fork. The angler catch data the survey has generated has helped to publicize, promote, and educate anglers about trophy bass fishing opportunities at Lake Fork Reservoir.

POSTER SESSION ABSTRACTS

Effects of Acclimation Time and Season on Post-Stocking Mortality of Red Drum in Fresh Water

Michael S. Baird *(Texas Parks and Wildlife Department, 8684 LaVillage Avenue, Waco, Texas 76712, michael.baird@tpwd.state.tx.us)*

The effects of acclimation time and season on post-stocking mortality of red drum in two Texas power plant reservoirs were evaluated using current Texas Parks and Wildlife Department (TPWD) rearing and hauling procedures. Red drum fingerlings were hauled to two reservoirs (Calaveras and Tradinghouse) during summer and fall, acclimated at two different time periods, moved to in-reservoir enclosures and counted daily for 72 h. Only 960 of 9,600 fingerlings survived the 72-h experiment. Reservoir and season had significant effects on survival as indicated by their main effects (P = 0.0016 and 0.0003) and two-way interaction (P = 0.0145). Calaveras stockings were generally more successful than Tradinghouse stockings and fall stockings had consistently better survival than summer stockings. Acclimation time was marginally significant (P= 0.0599), with fingerlings acclimated for 5 h typically having higher survival than those acclimated for 2.5 h regardless of reservoir or season. Results show red drum post-stocking survival would benefit from fall stockings and by acclimating fingerlings for at least 5 h prior to release.

Projected U.S. Distribution of Wildtype and Transgenic Zebra Danios *Danio rerio* Based on Temperature Tolerance Data

Cheryl Cortemglia *(Department of Biological Sciences, University of North Texas, P.O. Box 5218, Denton, TX, 76201, cc0115@unt.edu)*

Thomas L. Beitinger *(Department of Biological Sciences, University of North Texas, P.O. Box 5218, Denton, TX, 76201, beitingr@unt.edu)*

It is hypothesized that non-indigenous tropical fishes will not be able to survive the low temperatures of U.S. waters; however, numerous species have become established in U.S. waters. The zebra danio *Danio rerio* is a common aquarium fish and a genetically-modified version of this tropical species has become the first transgenic pet sold in the USA. We measured the temperature tolerances of over 60 wildtype and red fluorescent protein transgenic zebra danios via the chronic lethal method. The chronic lethal maxima of zebra danios acclimated to 30°C ranged from 39.0 to 40.0°C while the chronic lethal minima of zebra danios acclimated to 20°C ranged from 4.0 to 7.0°C. Two-way ANOVAs with variety and gender as main effects found the mean chronic lethal maxima of wildtype (39.8°C) and transgenic (39.3°C) zebra danios were significantly different, while the mean chronic lethal minima of wildtype (5.3°C) and transgenic (5.6°C) zebra danios were not significantly different. Neither lower nor upper temperature tolerances were related to gender. These data suggest that the distribution of either variety in the USA would not be limited by their upper temperature tolerance, and our low temperature tolerance data suggest that both varieties are capable of overwintering in southern U.S. waters.

Application of Population Dynamics Models to the Conservation of Imperiled Stream Fishes

Bart W. *Durham (Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Lubbock, TX 79409, bart.durham@ttu.edu)*

Gene R. Wilde *(Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Lubbock, TX 79409, gene.wilde@ttu.edu)*

The Arkansas River shiner *Notropis girardi* is a small minnow endemic to the Arkansas River drainage basin. Although once abundant throughout the basin, the species has declined during the past three decades. The Canadian River in New Mexico, Texas, and Oklahoma supports the two last viable populations of Arkansas River shiner. Population data collected by Jimmie Pigg between 1977-1995 documents major declines in the Oklahoma

population. Using this data set and published life-history information, we developed a population dynamics model for the Arkansas River shiner. Because reproductive success of the Arkansas River shiner is closely associated with stream discharge, we modeled survival of age-0 individuals as a function of stream discharge and used maximum likelihood analysis to determine the optimum relationship between observed and predicted abundance. The final model was evaluated using Akaike's Information Criterion. Results of this analysis indicate that population dynamics of Arkansas River shiner are related to stream discharge. The mathematical parameterization of the model also provides an objective method to determine the minimum average annual discharge necessary for population increase. The flexibility and utility of the model developed here has the potential to become an important tool for managers charged with conservation of imperiled stream-fish species.

Sex-Related Differences in Food Habits of the Inland Silverside

Maricruz Langoria *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 maricruz_ttu@hotmail.com)*
Caleb G. Huber *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 calebgh@hotmail.com)*
Christopher J. Chizinski *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 chris.chizinski@ttu.edu)*
Kevin L. Pope *(Wildlife and Fisheries Institute, Mail Stop 2125, Texas Tech University, Lubbock, Texas 79409-2125 kevin.pope@ttu.edu)*

Inland silverside are native to the eastern coast of the USA and have been introduced into numerous inland water bodies as prey for largemouth bass and striped bass. To better understand their biology and interactions in aquatic communities, we developed a bioenergetics model (growth = consumption – [respiration + egestion + excretion]) for inland silverside. Inland silversides were collected weekly for food habitat assessment by sex and size from May 2002 to November 2002. Prey items were enumerated by order and converted to caloric values. Seasonal variation in food habit composition occurred for adult and juvenile males and females. Sexually mature females consumed a greater proportion of energy-rich prey than juveniles or adult males. This difference in food habits is indicative of an annual species in which females invest a substantial proportion of their energy into reproduction.

Fish Biomarkers of Exposure to Thyroid Disrupting Contaminants in Aquatic Environments

Sandeep Mukhi *(Department of Environmental Toxicology and Texas Cooperative Fish and Wildlife Research Unit, Texas Tech University, Lubbock, Texas 79409-1160, sandeep.mukhi@tiehh.ttu.edu)*
Reynaldo Patiño *(U.S. Geological Survey Texas Cooperative Fish and Wildlife Research Unit and Departments of Range Wildlife and Fisheries Management and of Biological Sciences, Texas 79409-2120, Reynaldo.patino@ttu.edu)*

Some contaminants present in aquatic environments can disrupt thyroid function and impair fish health and reproduction. One such contaminant, perchlorate, inhibits iodide uptake by thyroid follicles and affects thyroid hormone production. Although several effects of perchlorate on the fish thyroid have been reported, the utility of these pathologies as markers of perchlorate exposure has not been adequately assessed. This study examined time-course and concentration-dependent effects of perchlorate on thyroid follicle hypertrophy, colloid depletion, and angiogenesis; alterations in whole-body thyroxine (T_4) levels; and somatic growth of zebrafish as research model. Changes in the intensity of the "colloidal T_4 ring" were also examined immunohistochemically. At 12 weeks of exposure, the lowest-observed-effect-concentration for colloid depletion, hypertrophy, angiogenesis and colloidal T_4 ring were 11,480; 1,131; 90; and 11 ppb, respectively. All changes were reversible after 12 weeks of recovery, but residual effects on angiogenesis and colloidal T4 ring intensity were still present after 12 weeks of recovery. Whole-body T_4 concentration and body growth were not affected by perchlorate. The sensitivity and longevity of changes in colloidal T_4 ring intensity and angiogenesis suggest their usefulness as novel markers of perchlorate exposure. These biomarkers are expected to assist in health assessments of fish populations.

Comparison of Maximum Size of Fish Caught with Recreational Angling and Standard Fish-collection Gears

Kevin L. Pope *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, kevin.pope@ttu.edu)*
Gene R. Wilde *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, gene.wilde@ttu.edu)*
Daryl L. Bauer *(Nebraska Game and Parks Commission, Lincoln, Nebraska 68503, dbauer@ngpc.state.ne.us)*

We asked "does standardized sampling provide meaningful information about the maximum size of fish produced within a given water body?" We addressed this question by correlating maximum lengths of freshwater fishes captured during 10 years with standard gears (i.e., gill nets, boat electrofishers and trap nets) and angling from Nebraska water bodies. Significant correlation was found in only one of nine sport fishes assessed. Thus, at present one cannot reliably predict the maximum size of fish that is likely to be caught with angling given the maximum size of fish captured with standard gears during routine monitoring of a fish population. Further, it appears that angler-supplied data may provide less-biased samples of the large-individual portion of freshwater fish populations than do standard gears.

The Rocky Barra Bounty: A Research-Driven Fishing Competition

William Sawynok *(Infofish Services, 142 Venables St., North Rockhampton, Queensland, Australia 4701, infofish@zbcom.net)*
Gene R. Wilde *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, gene.wilde@ttu.edu)*

The Rocky Barra Bounty, held each October on the Fitzroy River in Queensland, is one of the best known competitive fishing events in Australia. The main emphases of the competition are to: (1) provide anglers with a challenging competitive fishing event, (2) collect information that is used to monitor population dynamics of barramundi *Lates calcarifer* in the Fitzroy River; (3) and examine the relationship between angling practices and survival of released fishes. The competition is unique in organization and rules of conduct. Anglers capture, measure, tag, and release fish, and then must telephone in their capture information within 10 to 15 minutes to register the fish. Awards are given to the teams that catch the greatest cumulative lengths of fish (e.g., barramundi only, all species combined) and for the largest fish captured. To minimize the possibility of unethical behavior, major prizes are awarded by random draw. Results of the Barra Bounty indicate that the Fitzroy River barramundi population has increased in the past year and that population size structure has increased since 1999.

Effect of Angler Recaptures on Growth of Gold Spot Estuary Cod *Epinephelus coiodes* in Australia

Gene R. Wilde *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, gene.wilde@ttu.edu)*
William Sawynok *(Infofish Services, 142 Venables St., North Rockhampton, Queensland, Australia 4701, infofish@zbcom.net)*

We modeled growth of gold spot estuary cod *Epinephelus coiodes* captured, tagged, and released by anglers in coastal and estuarine waters of Queensland, Australia. Among recaptured fish, 82% (1,502) were recaptured once, 13% (232) were recaptured twice and 5% (93) were captured $\geq$3 times (range 3 to 8 recaptures, mean = 3.74). We estimated growth separately for three groups of fish: those recaptured once, twice, and 3+ times. We observed a quadratic relationship between growth and number of times fish were recaptured, with the greatest growth rates observed in gold spot estuary cod recaptured twice and least growth observed among fish captured 3+ times. Based on length at initial capture, time at liberty, and other capture details, we advance two explanations for these results. First, multiple (3+) recaptures may have an adverse affect on growth. Second, selective removal (harvest) of faster-growing fish may result in an over representation of slower-growing fishes in samples of fish that have been recaptured multiple times. We believe this second explanation is more likely.

An Individual-Based Model for Alligator Gar: Why Failing to Consider Intersexual Differences in Growth and Mortality Rates Leads to Overfishing

Gene R. Wilde *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, gene.wilde@ttu.edu)*
Kevin L. Pope *(Wildlife and Fisheries Management Institute, Mailstop 2125, Texas Tech University, Lubbock, Texas 79409, kevin.pope@ttu.edu)*
Allyse Ferrara *(Department Biological and Agricultural Sciences, Nicholls State University, Thibodaux, LA 70310, allyse.ferrara@nicholls.edu)*

We developed an individual-based model for alligator gar to evaluate the length at which harvest was maximized. We used two approaches. In the first, we ignored potential intersexual differences in growth and mortality rates, as is commonly done in fishery modeling. In the second approach, we explicitly modeled intersexual differences in growth and mortality rates. We found that ignoring sexual differences in population rates resulted in an estimate of 67-in TL, whereas including the sexual differences in rates resulted in an estimate of 76-in TL. Thus, ignoring these differences reduces harvest by at least 5%, results in growth-overfishing, and a 12% reduction in minimum length. Although our model is specific to alligator gar, it suggests that sexual differences need to be considered.

Comparison of Guided and Unguided Fishing Trips from Two Texas Reservoirs

JOHN H. MOCZYGEMBA AND BRUCE T. HYSMITH,

Texas Parks and Wildlife Department, Lake Texoma Fisheries Station,
P.O. Box 1446, Pottsboro, TX 75076

J. WARREN SCHLECHTE,

Texas Parks and Wildlife Department, Heart of the Hills Fisheries Science Center,
5103 Junction Highway, Ingram, TX 78025

Abstract. - We compared angling metrics and bait use during guided and unguided fishing trips on 16 Texas freshwater reservoirs from March 1997 to February 2000. Only Lakes Texoma and Fork had sufficient creel interviews of guided parties to analyze the desired differences between guided and unguided trips. At Lake Texoma, guided trips accounted for 60% of the directed effort for striped bass *Morone saxatilis*. Forty-six percent of the guided anglers used live bait; 77% of the striped bass harvested were taken during guided fishing trips. On Lake Fork, largemouth bass *Micropterus salmoides* anglers with or without guides had equal catch rates (largemouth bass per hour), but unguided anglers caught 81% of the largemouth bass. Unguided fishing trips accounted for 85% of the angling hours. Largemouth bass harvest was very low. Ninety-four percent of largemouth bass anglers used artificial lures; they caught almost 95% of the largemouth bass. We concluded striped bass anglers are more apt to employ a guide, use live bait, spend more time fishing, and guided anglers catch and harvest more fish than unguided anglers. Further, largemouth bass anglers are less likely to employ a guide and most will use artificial lures and release their catch. Guided and unguided anglers spend the same amount of time fishing per trip and catch equal number of largemouth bass per hour. Management implication for the striped bass fishery at Lake Texoma included striped bass harvest regulations, if needed, should be adapted to guided fishing trips. At Lake Fork, largemouth bass management should be applied to the largemouth bass anglers regardless of guide status.

Whether or not an angler catches a fish is determined by many variables. Knowing when and where to fish, and what type of gear and bait to use improves the likelihood of success. Guides provide this knowledge to their customers during a fishing trip. Guided trips can account for a disproportionate amount of the catch and/or harvest. Porak et al. (1997) reported anglers utilizing either of two fishing guides accounted for 63% of the largemouth bass *Micropterus salmoides* caught in Farm 13 Reservoir, Florida. Charter boat anglers had higher catch rates than other anglers in Lake Michigan (Hansen et al. 1990) and Lake Superior (Lockwood et al. 2001). Speir et al. (1977) found that charter boat fishing trips contributed 42% of the harvest by weight, while they totaled only 14.3 % of the angling trips made in the Maryland portion of the Chesapeake Bay. Studies for saltwater fisheries have also reported higher catch rates for charter- and head-boat anglers than private anglers (Briggs 1962, Frisbie and Ritchie 1963, Caillouet and Higman 1973, Maddux et al.1989, McEachron and Green 1983, Osburn et al.1988).

Which baits are more successful during guided and unguided trips? In a creel survey conducted on selected Oklahoma-owned reservoirs, Brown (1970) found catch by weight or numbers per hour did not appear strongly related to whether or not anglers used artificial lures, live bait, or dead bait. Along the Texas coast from May 1983 to May 1987, 61.2% of the anglers used natural bait, while 27.4% used artificial lures; fish landed by natural bait and artificial lures were 65.9 % and 24.9%, respectively (Weixelman and Chai 1991). This suggested the percentage of fishes landed by bait type was more indicative of bait use than of bait effectiveness. Ditton and Hunt (1996a) reported 23% of the black bass anglers in Texas would like

to restrict the use of live bait for black bass fishing. Other sport fish anglers may oppose any bait regulation. Before any regulations to limit types of bait are considered, it is important to measure the use of bait types (artificial lures, live fish, or other natural baits) and to quantify the catch and harvest attributed to each bait type.

As found in other studies, guided fishing trips can account for a significant part of the catch and harvest in a fishery, but specific data on guided trips are not available for Texas reservoirs. Information taken from guided trips could supplement species databases and help management biologists make decisions regarding species that are highly targeted by guided parties. Our first objective was to determine the differences in catch and harvest metrics of guided and unguided fishing trips in Texas reservoirs. Our second objective was to determine bait use and success during guided and unguided fishing trips.

Methods

We selected sixteen reservoirs, located throughout Texas, for evaluation from March 1997 to February 2000. We used standardized creel survey procedures for each reservoir as described by Texas Parks and Wildlife Department (TPWD) Inland Fisheries Assessment Procedures (unpublished, revised manual 1993). Each biologist chose the appropriate creel survey design (access or roving) for their reservoir. The biologist and his staff surveyed each reservoir 9 days per quarter (5 weekend days, 4 week days), except Lake Texoma, which was surveyed 12 days per quarter (6 weekend days, 6 week days). In addition to the standard creel questions, creel clerks asked each interviewed party: "Is this a guided party?" and "What type of bait are you using: artificial lures, live fish, natural bait, or a combination?" Number of directed anglers per party, number of directed anglers, number of directed hours for targeted species, % successful harvesting target species (at least one fish), directed catch and harvest (number/h) of targeted species, and average weight (kg) of targeted species harvested for guided and unguided fishing trips were determined for each quarter from angler interviews and boat/angler counts according to methods described by Malvestuto (1983) and Lambou (1961). We collected sufficient data to analyze twelve quarters (March 1997 to February 2000) for Lake Texoma and eight quarters (March 1998 to February 2000) for Lake Fork. The median quarterly value for each parameter for guided and unguided fishing trips for each lake was then compared. We tested data for normality using the Anderson-Darling test (SAS 1999). The data showed a non-normal distribution, so we used the nonparametric Wilcoxon Signed Rank (S) test for equality of catch and effort statistics for guided and unguided anglers. Although we recognize positive autocorrelation can result in an underestimation of the Type 1 error rate, we assumed independence because we had too few data to have a powerful test for autocorrelation. We conducted all statistical analyses using SAS Version 8.0 (SAS 1999). Treatment differences were declared significantly different at $P \leq 0.05$.

Using observed data from the creel interviews, we documented usage of and angler success with three different types of bait: artificial lures, live fish, and natural baits (stink baits, crickets, worms, water dogs, etc.) If the interviewed angler was using more than one type of bait, we asked the angler to enumerate the fish caught by each bait type. We stratified directed (fishing for a specific species) anglers by guide status (i.e., guided versus unguided) and bait type. To calculate the proportion in each stratum, we divided the number of directed anglers in each stratum by the total number of directed anglers. Likewise, to calculate the percentage of targeted fish caught (or harvested) in each stratum, we divided the number of targeted fish caught (or harvested) in each stratum by the total number of targeted fish caught (or harvested), respectively.

Results

Of 16 reservoirs sampled, only two, Lakes Texoma and Fork (Figure 1) had sufficient data for guided angling trips to analyze the difference in angler creel statistics between guided and unguided trips. Of 221 guided parties, out of 1,037 parties interviewed in a roving survey at Lake Texoma, 219 were seeking striped bass *Morone saxatilis*. Therefore, we compared only guided and unguided striped bass fishing trips from Lake Texoma. Of 83 guided parties, out of 1,427 parties interviewed in an access survey at

Lake Fork, 78 were seeking largemouth bass. Therefore, we compared only guided and unguided largemouth bass fishing trips from Lake Fork.

Lake Texoma

Almost half of the striped bass anglers (Table 1) were fishing with a guide. Guided parties had more anglers per party ($P < 0.01$) than did the unguided parties; discounting the presence of the guide, the difference was still more than one angler. Since guided fishing trips tended to be longer than unguided trips, there was more ($P = 0.03$) guided effort (angler-h/quarter) than unguided effort. Directed catch and harvest were typically higher during guided angling trips, although in the first quarter of 1998, unguided angling trips exhibited higher harvest. On average, 60% more striped bass were caught and twice as many were harvested during guided angling trips. In general, guided anglers caught larger striped bass than unguided anglers, although the difference was not significant ($P = 0.07$).

Most striped bass anglers used live fish, usually shad (*Dorosoma* sp.) during their fishing trip and they caught and harvested more striped bass (Table 2). Guided anglers using live fish accounted for about 46% of the striped-bass anglers, but those anglers accounted for over 68% of the striped bass caught and more than 70% of the striped bass harvested (Table 3). During unguided fishing trips, anglers used artificial lures and live bait almost equally, but regardless of bait choice, their catch and harvest rates (striped bass per angler) were much lower than anglers during guided trips. Guided fishing trips using live bait caught 6.2 striped bass per angler, the highest of any of the angler types.

Lake Fork

Unlike Lake Texoma, unguided parties at Lake Fork out-numbered the guided parties (Table 4, $P < 0.01$). Guided parties angling for largemouth bass had more anglers per party than did the unguided parties; the presence of the guide accounted for this, since the difference was less than one angler. Since unguided and guided fishing trips tended to be of the same duration, there was more unguided effort (angler h/quarter) than guided effort ($P < 0.01$). There was no difference in catch per h for unguided anglers compared to guided anglers ($P = 0.46$). Given more effort for unguided trips, and similar catch rates, unguided fishing trips produced over 80% of largemouth bass caught. Since interviewed guided anglers did not harvest any largemouth bass, we were unable to test which type of fishing trip was more successful in harvesting largemouth bass, or which type of trip had the highest harvest rate, or which type of trip harvested the bigger largemouth bass.

Approx 94% of largemouth bass anglers used artificial lures (Table 5), regardless of whether they fished with or without a guide. In addition largemouth bass anglers using artificial lures caught and harvested the majority of largemouth bass. However guided fishing trips using artificial lures caught 2.86 largemouth bass per angler, compared to 1.94 largemouth bass per angler caught during unguided fishing trips using artificial lures (Table 6).

Discussion

A guide is procured by an angler to catch fish. This was clearly true at Lake Texoma where guided striped bass fishing trips had a catch rate (1.66/h) 60% higher than unguided fishing trips (1.04/h). However, at Lake Fork, guided fishing trips for largemouth bass (0.40/h) had similar catch rates as unguided trips (0.35/h). Guided walleye fishing trips at Lake Erie had a higher catch rate than unguided walleye fishing trips from 1975 to 1999 (Lake Erie Fisheries Units 2000). Knapp and Goeman (2005) found walleye catch rates for guided trips were 2.6-4.7 times greater than those of unguided trips in five central Minnesota lakes. Although there was no harvest by guided fishing trips at Lake Fork, guided striped bass fishing trips at Lake Texoma had a harvest rate twice that of unguided fishing trips. Hansen et al. (1990) and Lockwood et al. (2001) observed the harvest rate by charter boats was close to double the harvest rate by non-charter boats fishing Lakes Michigan and Superior. Guided striped bass angling effort at Lake Texoma was 50% more than unguided angling effort, while guided largemouth bass angling effort at Lake Fork was only 20% of the hours expended for unguided angling effort. Guided

effort was low in the studies on Lakes Michigan, Superior, and Erie (Hansen et al. 1990, Lockwood et al. 2001, and Lake Erie Fisheries Units 2000). Therefore the total harvest from guided fishing trips was usually much less than the unguided fishing trips from these lakes. This trend was not observed at Lake Texoma, where guided striped bass fishing trips harvested over three times the number of striped bass than their unguided counterparts. Although harvest cannot be compared at Lake Fork because guided fishing trips did not take home any largemouth bass, unguided fishing trips at Lake Fork caught almost four times more largemouth bass than guided fishing trips.

Guided anglers at Lakes Texoma and Fork exhibited different angling characteristics. At Lake Texoma, guided striped bass anglers had an impact on the striped bass fishery. Guided striped bass anglers had a higher success rate ($P < 0.01$) in harvesting at least one striped bass than unguided striped bass anglers (96% vs. 56%). They were harvest oriented; guided anglers took 71% of the striped bass they caught home with them, while the unguided anglers took 60%. They caught ($P = 0.03$) and harvested ($P = 0.03$) more striped bass than their unguided counterparts and spent more time angling ($P < 0.01$). Guided anglers using live bait, the predominant bait of choice, accounted for 71% of the harvested striped bass. At Lake Fork, guided largemouth bass anglers had less impact on the largemouth bass fishery than unguided largemouth bass anglers. Both types of fishing trips were predominately catch-and-release fishing; only 2% of the largemouth bass caught were harvested. Trip duration for guided and unguided anglers did not differ ($P = 0.46$; Table 5). Both types of anglers had similar catch rates ($P = 0.46$). However there were more unguided anglers ($P < 0.01$) and effort expended during unguided fishing trips was higher ($P < 0.01$). Unguided fishing trips caught almost four times more largemouth bass than guided fishing trips. The predominant bait used by guided and unguided largemouth bass anglers was artificial lures, which caught the most largemouth bass (Table 6).

The difference in inter-specific angler response indicates the role played by these two sport fishes in Texas. The striped bass fishery at Lake Texoma is a consumptive-based fishery; i.e., fish are harvested and taken home to eat. Hunt and Ditton (1998) reported that the size of striped bass preferred for eating by 70% of Lake Texoma striped bass anglers measured 15 to 20 inches in length. The overwhelming majority of striped bass harvested at Lake Texoma from December 1996 to November 1999 was between 14 and 20 inches (Hysmith et al. 1998, 1999, and 2000). Ditton and Hunt (1996a) found that 49.1% of Texas black bass anglers considered it moderately important to extremely important to catch a trophy fish as a reason for fishing. They also observed that 61% did not go fishing to obtain fish for eating.

Why do a high percentage of anglers use a guide at Lake Texoma and not at Lake Fork? Guided striped bass anglers were the youngest group fishing Lake Texoma and were more likely to indicate having lower skill levels than other anglers (Hunt and Ditton 1998). Half of the striped bass anglers interviewed were guided (Table 2). Lake Fork anglers were nearly four times more likely than statewide black bass anglers to rate themselves as more skilled compared to other anglers (30% vs. 8%; Hunt et. al. 1996). Almost 10 times more anglers fished for largemouth bass on Lake Fork without a guide.

Ditton and Hunt (1996b) reported that 61% of Texas anglers interviewed responded that they are happier when they catch more fish. If a specific bait type is more successful at catching fish, then anglers would tend to use that bait if they wanted to catch more fish. However, catch success by bait type could be more indicative of bait use rather than bait effectiveness. At Lake Texoma, most striped bass anglers used live fish (72%); anglers using live fish also caught the most striped bass (81%) (Table 2). Of the 81% striped bass caught with live fish, guided anglers contributed 68% as opposed to 13% caught by unguided anglers. This difference was also evident in the striped bass harvest (Table 3). Almost 94% of the largemouth bass anglers at Lake Fork used artificial lures to catch 95% of the largemouth bass, which may have been more indicative of bait usage rather than guide status. Brown (1970) found live bait, artificial lures, and dead bait were used by 29%, 21%, and 6%, respectively, of the

angling parties at 10 Oklahoma reservoirs. Brown (1970) also reported parties using live bait caught more fish (4.4/trip) than artificial lures (2.8/trip) or dead bait (2.7/trip). However, Brown (1970) stated that catch-per-hour and weight-per-hour did not appear strongly related to bait usage. In a creel survey on the Texas coast from 1983 to 1987, 28,092 angling parties harvested 32,226 fish (Weixelman and Chai 1991). Natural bait was used by 59% of the angling parties, while artificial lures were utilized by 38% and live fish by 3% of the angling parties. Angling parties using natural bait harvested an estimated 71% of the fish. Those using artificial lures harvested 27% of the fish, followed by 2% for anglers using live fish. From 1987 to 1997, another creel survey on the Texas coast interviewed 98,400 parties, who harvested 445,187 fish (Morris et al. 1999). In this study, usage of baits by angling parties was 58% natural bait, 31% artificial lures, and 11% live fish. Angling parties using natural bait harvested an estimated 61% of the fish. Parties using artificial lures retained 28% of the fish, while using live fish harvested 11%. In both salt water studies, the harvest success by bait type was more indicative of bait use rather than bait effectiveness.

Results of this study provided some insight to the management of the dominant fisheries on Lakes Texoma and Fork. Monitoring the striped bass guided-angler catch and harvest would supply information on the status of the striped bass population at Lake Texoma. The striped bass fishery at Lake Texoma is highly impacted by guided fishing trips. To be effective any striped bass harvest regulation would have to be adapted for striped bass guided-fishing trips. Restrictions on live bait, although very unpopular (Hunt and Ditton 1998), may become necessary if angler induced mortality or over-harvest of striped bass becomes a problem. At Lake Fork, a creel survey would also provide some information on the largemouth bass population that other sampling methods do not. Guided fishing trips are a small part of the overall largemouth bass fishery. Therefore, effective largemouth bass harvest regulations should be based on all largemouth bass fishing trips. Since artificial bait is the predominant bait for largemouth bass, use of live bait for largemouth bass fishing would not be an issue. The largemouth bass fishery at Lake Fork is mostly catch-and-release; angler-induced mortality of largemouth bass could be a problem for the abundance of fish less than trophy size. This could possibly be controlled by a size limit on artificial bait as suggested by Wilde et. al (2003).

Acknowledgements

We thank TPWD personnel from the Inland Fisheries Management Districts in the Inland Fisheries Division and Oklahoma Department of Wildlife Conservation personnel, R. E. Currie, P. E. Mauck, and R. S. Wichers, who assisted with creel surveys. D. Strickland and R. Myers (TPWD) helped develop programs for analyzing creel data. We greatly appreciate editorial comments by TPWD personnel, R. Luebke, R. McCabe, B. VanZee, and Inland Fisheries Region Two Management biologists. This project was partially funded by the Federal Aid in Sport Fish Restoration Act under Project F-30-R of the TPWD.

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TABLE 1. Estimated creel parameters for guided and unguided striped bass fishing trips on Lake Texoma, Texas-Oklahoma, 1 March 1997 to 29 February 2000. Hypothesis tests compare guided to unguided estimates using the Wilcoxon Signed Rank Test (*S**). Treatment differences were declared significantly different at $P \leq 0.05$.

	Quarterly Median			
Parameter	Guided	Unguided	|*S**|	*P* value
Anglers per directed party	4.05	2.40	39	<0.01
Directed parties	8,247	15,359	37	<0.01
Directed anglers	33,903	35,029	8	0.60
Trip duration (hours)	3.6	2.5	39	<0.01
Effort (angler hours)	119,067	78,184	28	0.03
% Parties successful harvesting at least one striped bass	95.6	56.3	39	<0.01
Directed catch (number/h)	1.66	1.04	28	0.03
Directed harvest (number/h)	1.18	0.54	27	0.03
Average weight striped bass (kg)	0.91	0.83	23.5	0.07

TABLE 2. Catch and harvest statistics of striped bass fishing trips during a creel survey at Lake Texoma, Texas-Oklahoma, 1 March 1997 to 29 February 2000. Summary statistics are observed data stratified by guide status and bait-type. Data were taken from 583 creel interviews of 1816 striped bass (SB) anglers. (G=guided angler, U=unguided angler, A=artificial lures, F=live fish, NB=natural bait)

Guide Status	Bait Type	Anglers	% of Anglers	SB Caught	% of SB Caught	SB Caught/angler	Harvested SB	% of Harvested SB	Harvested SB/angler
G		919	51	5595	74	6.10	3988	77	4.34
U		897	49	1953	26	2.18	1162	23	1.30
	A	503	28	1436	19	2.85	773	15	1.54
	F	1306	72	6110	81	4.68	4375	85	3.35
	NB	7	<0.5	2	<0.5	0.29	2	<0.5	0.03

TABLE 3. Catch and harvest statistics of striped bass fishing trips during a creel survey at Lake Texoma, Texas-Oklahoma, 1 March 1997 to 29 February 2000. Summary statistics are observed data stratified by guide status with bait-type. Data were taken from 583 creel interviews of 1816 striped bass (SB) anglers. (G=guided angler, U=unguided angler, A=artificial lures, F=live fish, NB=natural bait)

Guide Status	Bait Type	Anglers	% of Anglers	SB Caught	% of SB Caught	SB Caught/angler	Harvested SB	% of Harvested SB	Harvested SB/angler
G	A	82	5	440	6	5.37	343	7	4.18
G	F	834	46	5153	68	6.18	3643	71	4.37
G	NB	3	<0.5	2	<0.5	0.67	2	<0.5	0.67
U	A	421	23	996	13	2.37	430	8	1.02
U	F	472	26	957	13	2.03	732	14	1.55
U	NB	4	<0.5	0	0	0.00	0	0	0.00

TABLE 4. Estimated creel parameters for guided and unguided largemouth bass fishing trips on Lake Fork, Texas, 1 March 1998 to 29 February 2000. Hypothesis tests compare guided to unguided estimates using the Wilcoxon Signed Rank Test (S^*). Treatment differences were declared significantly different at $P \leq 0.05$.

	Quarterly Median			
Parameter	Guided	Unguided	$\lvert S^* \rvert$	*P* value
Directed anglers per party	2.57	1.86	18	<0.01
Directed parties	622	6,416	18	<0.01
Directed anglers	1,888	11,026	18	<0.01
Trip duration (hours)	5.0	5.1	6	0.46
Effort (angler hours)	10,181	56,079	18	<0.01
Directed catch (number/h)	0.40	0.35	6	0.46

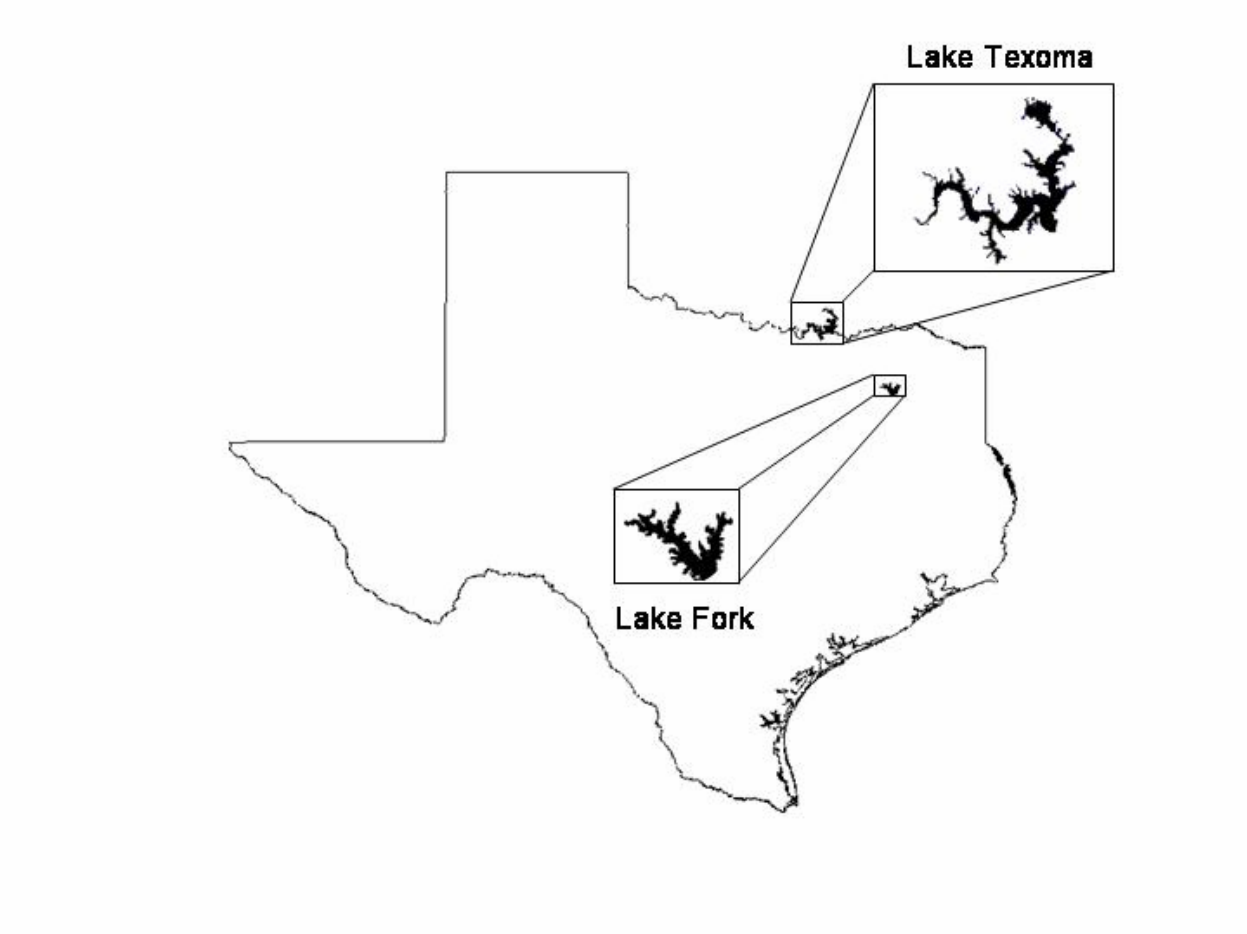
TABLE 5. Catch and harvest statistics of largemouth bass fishing trips during a creel survey by guide status and bait-type, Lake Fork, Texas, 1 March 1998 to 29 February 2000. Summary statistics are observed data stratified by guide status and bait-type. Data were taken from 693 creel interviews of 1424 largemouth bass (LMB) anglers (G=guided angler, U=unguided angler, A=artificial lures, F=live fish, NB=natural bait).

Guide Status	Bait Type	Anglers	% Anglers	LMB Caught	% of LMB Caught	LMB Caught/angler	Harvested LMB	% of Harvested LMB	Harvested LMB/angler
G		196	14	561	19	2.86	0	0	0.00
U		1228	86	2372	81	1.93	44	100	0.04
	A	1338	94	2778	95	2.08	41	93	0.03
	F	41	3	41	1	1.00	2	5	0.05
	NB	45	3	114	4	2.53	1	2	0.02

TABLE 6. Catch and harvest statistics of largemouth bass fishing trips during a creel survey by guide status and bait-type, Lake Fork, Texas, 1 March 1998 to 29 February 2000. Summary statistics are observed data stratified by guide status with bait-type. Data were taken from 693 creel interviews of 1424 largemouth bass (LMB) anglers (G=guided angler, U=unguided angler, A=artificial lures, F=live fish, NB=natural bait).

Guide Status	Bait Type	Anglers	% Anglers	LMB Caught	% of LMB Caught	LMB Caught/angler	Harvested LMB	% of Harvested LMB	Harvested LMB/angler
G	A	196	14	561	19	2.86	0	0	0.00
G	F	0	0	0	0	0.00	0	0	0.00
G	NB	0	0	0	0	0.00	0	0	0.00
U	A	1142	80	2217	76	1.94	41	93	0.04
U	F	41	3	41	1	1.00	2	5	0.05
U	NB	45	3	114	4	2.53	1	2	0.02

FIGURE 1. Locations of Lakes Texoma and Fork used in a creel study to determine the angling characteristics of guided and unguided fishing trips, 1 March 1997 to 29 February 2000.



Acknowledgments

The contributions of the abstract authors and the Editorial Committee (Craig Bonds, Mandy Scott, and Tim Bonner) towards the preparation of this Proceedings is gratefully acknowledged

The entire Chapter is appreciative to the many contributors who donated auction and raffle goods, money, and services for the 2005 meeting in Grapevine, Texas

Citation:

Author(s). 2006. Title. Pages ____ in C. C. Bonds, editor. Annual Proceedings of the Texas Chapter, American Fisheries Society, Volume 27. Texas Chapter, American Fisheries Society, Austin, Texas.

ISSN 1060-2224