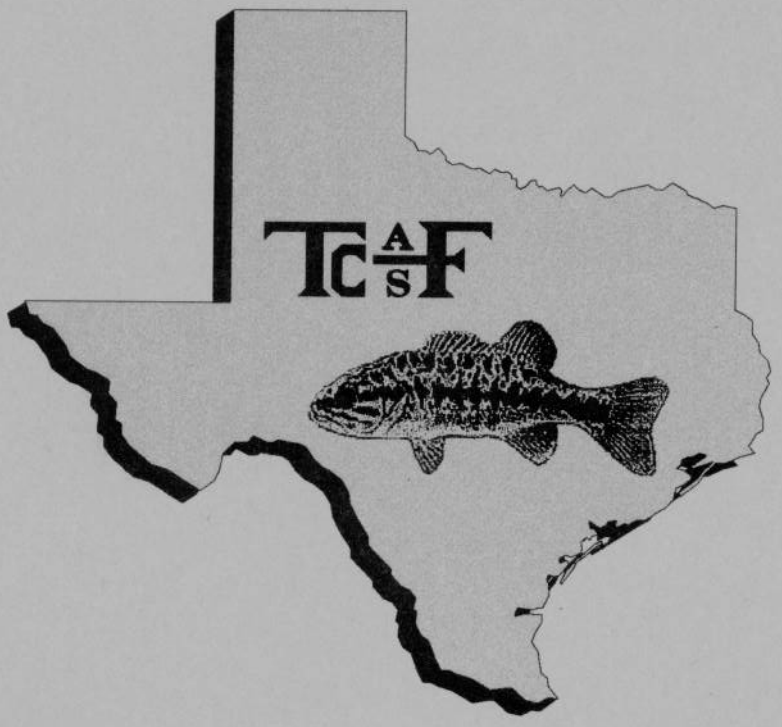
ANNUAL PROCEEDINGS of the TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY



College Station, Texas
10 - 12 September 1995

VOLUME 18

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 anually at a time and place designated by the Executive Committee.

MEMBERSHIP

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

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

Annual membership dues are $8 for Active Members and $5 for Student Members.

ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER AMERICAN FISHERIES SOCIETY

Annual Meeting
10 - 12 September 1995
College Station, Texas

1995 - 1996 Officers

Mark Webb, President
Texas Parks and Wildlife Department

Katherine T. Ramos, President-Elect
Texas Parks and Wildlife Department

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Texas Parks and Wildlife Department

1996

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

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Posters presented at the Annual Meeting:

PAST TEXAS CHAPTER PRESIDENTS AND MEETING LOCATIONS

DATE	PRESIDENT	LOCATION
1976		College Station
1976	Ed Bonn	Lake Brownwood
1977	Jim Davis	San Antonio
1978	Bill Rutledge	San Marcos
1979	Bobby Whiteside	College Station
1980	Richard Noble	Arlington
1981	Charles Inman	Austin
1982	Gary Valentine	Kerrville
1983	Don Steinbach	Lake Texoma
1984	Gary Matlock	Port Aransas
1985	Maury Ferguson	Junction
1986	Brian Murphy	San Marcos
1987	Joe Tomasso	Kerrville
1988	Dick Luebke	Abilene
1989	Mac McCune	San Antonio
1990	Bobby Farquhar	Lake Texoma
1991	Gene McCarty	Galveston
1992	Bill Provine	Kerrville
1993	Barbara Gregg	Port Aransas
1994	Loraine Fries	Lake Travis
1995	Pat Hutson	College Station
1996	Mark Webb	Pottsboro

TEXAS CHAPTER AWARDS

Eight awards may be presented annually. Only members in good standing may make nominations. If nominations reviewed by the Awards Committee are found to be inadequate in one or all categories, awards need not be given. If multiple nominations are received and more than one nominee is considered outstanding, multiple recipients are permissible. The awards and their associated criteria are:

Outstanding Fisheries Worker of the Year - The nominees must be Chapter members in good standing. There are six specialization categories: Administration, Culture, Education, Management, Research, and Technical Support. An award may be presented in each area of specialization. All nominations must be accompanied by supporting data on contributions to one particular area of focus.

Special Recognition in Fisheries Work - The nominees do not have to be Chapter members. They may be individuals or organizations that have made substantial contributions to fisheries in Texas.

Outstanding Presentation at the Annual Meeting - The basic requirements are:

a. The presentation must be made by one of the authors.
b. At least one of the authors must be a Chapter member in good standing.
c. Members of the current Awards Committee shall be ineligible.

The award is for the presentation, not a manuscript or paper. Criteria for evaluation, made by the Awards Committee, and their relative values are:

a. Introduction - 10 points
b. Methods - 10 points
c. Organization - 10 points
d. Originality - 15 points
e. Technical Merit - 20 points
f. Delivery - 15 points
g. Visual Aids - 15 points
h. Other considerations - 5 points

Judges will evaluate each presentation immediately after it is given. They will not confer until after the last presentation. The decision will be made based on relative rankings assigned by the judges.

Scholarship Selection - Selection of scholarship recipients is made by members of the Scholarship Selection Committee. University representatives nominate students from their institutions for scholarship consideration. Selection is based on the following criteria:

a. Academic excellence
b. Professional activities
c. Promise of future professional involvement and significant contribution to the field of fisheries science.

1995 TEXAS CHAPTER AWARD RECIPIENTS

Roger McCabe of the Texas Parks & Wildlife Department was recognized as the **Outstanding Fisheries Worker of the Year for Administration**. Roger was acknowledged for his leadership in administrating several statewide and regional programs including the striped bass program (broodstock procurement, spawning, and stocking) and the statewide stocking program for all fish species. He manages the Texas Parks and Wildlife Department's fish, shellfish, and aquatic plant permitting program for introductions into Texas waters. He works with the U.S. Fish and Wildlife Service on Section 7 (Endangered and Protected Species) compliance as it applies to fish stocking. He has provided leadership in public outreach by organizing the ''Pathways to Fishing'' booth at the Texas Parks and Wildlife Expo from 1993 to 1995. He also organized and directed the Striped Bass Symposium at the 1995 Southern Division American Fisheries Society mid-winter meeting in Virginia Beach, Virginia. He has been the Regional Director for Region 2 of the Inland Fisheries Division for 19 years.

Robert Adami of the Texas Parks & Wildlife Department was recognized as the **Outstanding Fisheries Worker of the Year for Culture**. As Marine Enhancement Manager at Texas Parks & Wildlife Department's Perry R. Bass Marine Fisheries Station in Palacios, he re-organized the research facility for fish production. The station went on-line in 1993 to raise red drum and spotted sea trout fingerlings. Each year he produced more than the year before: 1993 - 12.2 million red drum fingerlings; 1994 - 13.6 million red drum fingerlings and 1.4 million spotted sea trout fingerlings, and 1995 (mid-season) - 9.7 million red drum fingerlings.

Dr. William E. Neill of the Department of Wildlife and Fisheries Sciences, Texas A&M University, was recognized as the **Outstanding Fisheries Worker of the Year for Education**. For 2 decades, Dr. Neill has been training Texas A&M undergraduate and graduate students in fisheries sciences. His fishery seminars and courses in fish biology, vertebrate physiological ecology, and professionalism have been cornerstones of Texas A&M's fishery program for a long time. He integrates his current research with classroom and field instruction to provide an excellent atmosphere for learning. Students come away from his courses and his lab with solid knowledge of the ins and outs of both fishery science and real world problems of aquaculture and natural resource management. As chair of the Department of Wildlife's graduate admissions committee, he carefully evaluates over one hundred graduate applicants each year.

Spencer C. Dumont of the Texas Parks & Wildlife Department was acknowledged as **Outstanding Fisheries Worker of the Year for Management**. Spencer has studied day versus night electrofishing and is studying a length limit harvest regulation for largemouth bass in Brownwood and Coleman Reservoirs and blue catfish in Ft. Phantom Hill and E. V. Spence Reservoirs. He also is working on re-vegetating Coleman Reservoir with coontail. Spencer worked with the City of Abilene in controlling water levels to enhance spawning in Trammel Reservoir. During the past 1½ years, he has been involved in seven special fishing events that have reached more than 700 youth and special groups. He also has given 14 presentations to clubs and organizations. He worked closely with the Abilene Recreation Department in organizing youth fishing events and improving fishing access to city lakes. His enthusiasm for fisheries is infectious and inspires the rest of the staff to do their best at all times.

Dr. Maurice I. Muoneke of the Texas Parks & Wildlife Department was recognized as **Outstanding Fisheries Worker of the Year for Research**. Dr. Muoneke designed, directed, and completed a 4-year study on population dynamics and exploitation of white bass in Texas. He also conducted a 2-year study of hooking mortality for spotted bass, Guadalupe bass, white crappie, bluegill, blue catfish, and flathead catfish. Dr. Muoneke has co-authored two major review papers "Biology and management of grass carp: literature review" and "Hooking mortality: a review for recreational fisheries." His papers have been published in *North American Journal of Fisheries Management, Aquaculture and Fisheries Management,*

Warmwater Fisheries I Symposium, and *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies*. For the past 2 years, he has been developing databases for coastal fisheries creel and resource monitoring data and the hatcheries fish distribution data. In 8 years with the department, his collaborative research efforts with other fishery scientists and involvement in the development of databases have contributed significantly to all aspects of freshwater and saltwater fishery management in Texas.

Tom Heffernan and **Robin Reichers** of the Texas Parks & Wildlife Department were awarded a **Special Recognition in Fisheries Work**. They worked together to help bring to fruition the Texas Gulf Shrimp Limited Entry Plan. Tom and Robin conducted a series of coastwide workshops with shrimpers to educate them on what limited entry was and what the process was for developing a plan. Despite extensive industry resistance for changing their ways in combination with the shrimpers' distrust of the department, Tom and Robin were able to establish a core group of area leaders and began forging a bond of trust and cooperation. They held a second series of coastwise workshops to begin developing a consensus of agreement on the initial framework of a joint plan. After consensus they helped the shrimpers work through the legislative process so the limited entry plan could become law. That legislation, Senate Bill 750, was passed unanimously in both the House and Senate.

Dr. Sterling (Ken) Johnson of the Texas Agricultural Extension Service was awarded a **Special Recognition in Fisheries Work**. In his role as the state's foremost fish disease specialist, Dr. Johnson has served the people of Texas for nearly 25 years. He has provided his expertise to Extension Service as a specialist and to the Department of Wildlife and Fisheries Sciences of Texas A&M University as a professor. He has assisted government agencies, large and small landowners, and the Texas aquaculture industry.

Jay Rooker (University of Texas Marine Science Institute), **Robert Weller** (Texas Tech University), **Gil Rosenthal** (University of Texas at Austin), and **John Findiesen** and **Karen Quinonez** (Southwest Texas State University) each were awarded $500 scholarships.

PAST 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 (SWTSU)
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 (CCSU), Michelle Badough (SWTSU)

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 (SWTSU), 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 (SWTSU)
Scholarships - Kathyrn Cauble (SWTSU), 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) - to be announced at 1996 Annual Meeting
Scholarships - Jay Rooker (UTMSI), Robert Weller (TTU), Gil Rosenthal (UT),
John Findiesen and Karen Quinonez (SWTSU)

Abbreviations:

TPWD - Texas Parks and Wildlife Department
TAMU - Texas A&M University
TAES - Texas Agricultural Extension Service
SWTSU - Southwest Texas State University
UTMSI - University of Texas Marine Science Institute
UT - University of Texas at Austin
SCS - Soil Conservation Service
USFWS - US Fish and Wildlife Service
UTPA - University of Texas/Pan American
TTU - Texas Tech University
CCSU - Corpus Christi State University
TUGC - Texas Utilities Generating Company

Technical Session Abstracts

A Model for Estimating Densities of Largemouth Bass Using Electrofishing Catch Per Unit Effort

C. M. Edwards (Texas Parks and Wildlife Department, 6200 Hatchery Road, Fort Worth, Texas 76114), R. W. Drenner, K. L. Gallo, and K. E. Rieger (Department of Biology, Texas Christian University, Fort Worth, Texas 76129)

Fourteen experimental ponds (0.18-0.58 hectare) with turbidities ranging from 2.5 to 34.0 NTU were each sampled twice by night-time electrofishing. Ponds were drained and all largemouth bass *Micropterus salmoides* (total length, ≥200 mm) were weighed and measured. Electrofishing catch per unit effort (CPUE) was not correlated with aquatic macrophyte biomass, turbidity, or conductivity but was strongly correlated ($r^2 = 0.75$, $P < 0.001$) with population density of bass. Based on a regression analysis, largemouth bass population density (PD, number/hectare) can be estimated by the equation PD = 181.912X ($r^2 = 0.92$, $P < 0.001$) where X is the number of largemouth bass (≥200 mm) electrofished per minute.

Phantom Lake Spring Refugium for Two Endangered Fishes

A. A. Anderson and K. O. Winemiller (Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258)

Populations of the endangered species, Comanche Springs pupfish *Cyprinodon elegans* and Pecos gambusia *Gambusia nobilis*, are threatened by water loss due to increased irrigation demands as well as potential hybridization with non-native congeners. A refugium for these species was constructed in 1993 by the U.S. Bureau of Reclamation in conjunction with the Texas Parks and Wildlife Department. The refugium is a 110 m long, 50 cm deep (maximum) channel with alternating narrow (3 m wide) and pool (4-6 m wide) sections. A stair-step cross-sectional design provides for a depth gradient. Monitoring of the fishes began in late 1993, and populations of both species have increased as percent vegetative cover increased. There were 132 *C. elegans* and 863 *G. nobilis* by August 1995. Although *C. elegans* was slightly more abundant in warmer, slower-flow pool sections, neither species had a preference for any section of the refugium. Abundance of *G. nobilis* was positively correlated with temperature ($r = 0.297$) and dissolved oxygen at midchannel ($r = 0.289$, $P \leq 0.05$) and at channel edge ($r = 0.275$); corresponding environmental associations were not significant ($r \leq 0.20$, $P > 0.088$) for *C. elegans*. Non-native *G. geiseri* and native predator *Astyanax mexicanus* invaded the refugium prior to the introduction of the endangered species; however, their populations have not had much effect on abundances of the refugium species.

Patterns of Resource Use by Three Species of Peacock Bass *Cichla spp.* in the Cinaruco River, Venezuela

D. B. Jepsen (Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258)

The Cinaruco River forms the southern boundary of the recently established Santos Luzardo National Park in southern Apure State, Venezuela. Sportsfishing for native Peacock Bass *Cichla temensis*, *C. orinocensis*, and *C. intermedia* in the Cinaruco has increased in recent years and there is anecdotal evidence that fish populations are declining. Ecological data for these species were collected during 1993 and 1994 to document seasonal use of resources and population size structure. *Cichla temensis* was the largest (mean standard length [MSL], 381 mm) and most numerous species (56% of catch), and inhabited both lagoon and main-channel habitats. *Cichla orinocensis* (MSL, 302 mm; 0.27% of catch) was also common in river and lagoon habitats, while *C. intermedia* (MSL, 308 mm; 0.17% of catch) was associated with flowing water areas. Smaller fishes (< 100 mm) preyed mostly on zooplankton, while larger fishes were almost completely piscivorous. Seasonal water level fluctuation in this tropical floodplain system influences prey availability, fish condition, and time of spawning. Gonad condition, the presence of nuchal humps, and observation of nesting adults indicated that spawning was most common in the low water season. Management scenarios that aim to maintain this important sports fishery must consider aspects of *Cichla* life histories that make them vulnerable to overexploitation. In addition, enforcement of catch limits must be improved, and existing catch-and-release practices must be modified to enhance the survival of released fish.

Spawning Behavior and Seasonal Variations in Home Range Size and Habitat Preference of Flathead Catfish in a West Texas Reservoir

R. R. Weller and J. D. Winter (Department of Range, Wildlife and Fisheries, Texas Tech University, Lubbock, Texas 79409)

Ultrasonic telemetry was used to determine spawning behavior and seasonal variations in home range size and habitat use of adult flathead catfish *Pylodictus olivaris* in a 93-hectare reservoir in west Texas. We implanted temperature-sensing ultrasonic transmitters in 29 catfish: 16 males (1.1-3.7 kg); 10 females (1.4-17.9 kg); and three others (undetermined sex). Fish were monitored from June 1993 through July 1995. During all seasons flathead catfish preferred substrates consisting of rocks and large boulders and woody cover. Flathead catfish were found at shallower depths during spring and summer (1-4.9 m) than in late fall and winter (>6 m). Flathead catfish began to migrate to deeper water in late fall when mean surface temperatures were between 14 and 22°C. Home ranges were significantly smaller during winter than in summer for both males and females ($P < 0.001$). There were no significant differences in home range sizes during summer or winter based on size ($P = 0.54$) or sex ($P = 0.33$). Spawning occurred during June and July when water temperatures exceeded 24°C. Most tagged catfish spawned in the large rip-rap of the dam in less than 4 m of water. The presence of cavities created by the rip-rap may provide excellent spawning habitat.

Stress Response of Juvenile Largemouth Bass to Herbicides: Preliminary Characterization of the Response to Handling

E. D'Silva, J. Winter, and R. Patiño (Department of Range, Wildlife and Fisheries, Texas Tech University, Lubbock, Texas 79409)

Preliminary experiments were conducted with juvenile largemouth bass *Micropterus salmoides* to determine baseline plasma cortisol, glucose, and osmolality values in unstressed fish and to determine the acclimation periods required for the recovery from hauling and the acute stress of handling and transfer. Mean glucose levels (143 mg/dL) were significantly higher ($P \leq 0.05$) and osmolality levels (237 mosmol/L) were significantly lower upon arrival from the supplier when compared to the subsequent baseline levels achieved within the following 5 weeks in the holding tanks. Mean cortisol levels were relatively low (0.3967 ng/mL) and did not change during this initial acclimation period. Handling and transfer of the fish to the bioassay system resulted in significant elevations in cortisol (2.1 ng/mL) and glucose levels (128 mg/dL), but these levels returned to baseline conditions within 24 h. No change was observed in plasma osmolality probably because the fish were held in isotonic water during transfer. These data suggest that the acclimation period for recovery from hauling should be no less than 4 weeks, while the recovery period from acute stress should be at least 1 d and preferably 1 week.

Evaluation of a Shorter Pond Filling Interval to Control Fairy Shrimp and Clam Shrimp Densities in Florida Largemouth Bass Rearing Ponds

G. Kurten, L. Hall, and N. Thompson (Texas Parks and Wildlife Department, Jasper State Fish Hatchery, Jasper, Texas 75951)

Fish production and zooplankton densities with a pond filling interval of 7 d prestocking (7-d ponds) were compared to those of a 14-d prestocking interval (14-d ponds) to determine if earlier stocking could reduce fairy shrimp and clam shrimp densities through fish predation. Fish production (33.7 kg/hectare) and growth (0.98 mm/d) were similar in both treatments but the largemouth bass fingerlings did not reach the target production size of 38 mm. The densities of shrimp and numbers of shrimp reaching reproductive size were lower in the 7-d ponds than in the 14-d ponds. Although the 7-d filling to stocking interval appeared to have been a good non-chemical method to reduce shrimp densities, it apparently did not provide an adequate forage biomass to rear fingerling largemouth bass to 38 mm at the fish densities tested of 384,000 fry/hectare.

Range Expansion of the Invasive Brown Mussel *Perna perna*

M. McGrath (Center for Coastal Studies, Texas A&M University-Corpus Christi, Corpus Christi, Texas 78412), S. Jacks, and T. Serota (Fishery Resources Office, U.S. Fish and Wildlife Service, Corpus Christi, Texas 78412)

The invasive brown mussel *Perna perna*, first seen on the jetties at Port Aransas, Texas, in February 1990, is expanding its range along the Gulf coast of Texas. A monitoring program to document brown mussel range expansion and determine effects on utility and navigational structures was begun in May 1995 by the Corpus Christi Fishery Resources Office (U.S. Fish and Wildlife Service). Fourteen sites along the Texas coast were sampled and *P. perna* was found to have expanded its range northward and into the bay systems and Intracoastal waterway. Further range expansion will be monitored by examining artificial substrates, deployed in four major water inlets along the Texas coast from the Brazos River southward to Cedar Bayou, at 3- or 6-month intervals until September 1997.

Occurrence of *Anguillacola crassus*, a Parasitic Swim Bladder Nematode, in North America

L. T. Fries, D. J. Williams, (Texas Parks and Wildlife Department, A. E. Wood State Fish Hatchery, San Marcos, Texas 78667), and S. K. Johnson (Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843-2258)

In February 1995, the Texas Parks and Wildlife Department was asked by the Texas Natural Resource Conservation Commission to investigate an aquaculture facility that was raising eels. There was concern that the eels may have been infected with *Anguillicola crassus*, a swim bladder parasite that had detrimental effects upon European eel fisheries following its introduction from Asia in the early 1980s. Eight of the 23 eels examined at the aquaculture facility were infected with the parasite. To determine the extent of the infection, wild eels from Texas rivers and from Winyah Bay, South Carolina were collected and examined. No swim bladder parasites were found in the eels from Texas, but one of the eels from South Carolina was infected with an immature *A. crassus*. These are the first reported occurrences of *A. crassus* in North America.

RNA:DNA Ratio as a Condition Index for Larval and Juvenile Red Drum *Sciaenops ocellatus*

J. R. Rooker and G. J. Holt, Department of Marine Science (The University of Texas at Austin, Port Aransas, Texas 78373)

RNA:DNA ratios from individual red drum *Sciaenops ocellatus* were measured using laboratory-reared larvae and juveniles to assess the effects of growth and starvation on biochemical condition. RNA:DNA ratios were correlated positively with both standard (mm/d) and instantaneous (%/d) growth rates. The effect of starvation was evaluated daily over 5-d periods at three ontogenetic stages (20, 30, and 40 d). RNA:DNA ratios decreased continuously over the entire 5-d starvation period and starved larvae were statistically different ($P < 0.05$) from fed larvae within 1 or 2 d of food deprivation. These results support the utilization of RNA:DNA ratios as indices of growth and nutritional condition for laboratory-reared red drum and led to investigating field applications of RNA:DNA ratios. Nucleic acids were quantified for individual larval and juvenile red drum collected from estuarine seagrass habitats located near Port Aransas, Texas. Multiple regression analyses indicated that standard length and temperature were significant factors and the model accounted for 55% of the variability in RNA:DNA ratios of individuals from natural populations. RNA:DNA ratios increased approximately 1.0-1.2 per °C and 1.0-1.4 per mm of length. The effects of site (bay system) and habitat type (*Thalassia testudinum*, *Halodule wrightii*) also were assessed and no differences in RNA:DNA ratios were detected among bay systems ($P = 0.895$) or between habitat types ($P = 0.316$).

pH-Related Mortality of Red Drum *Sciaenops ocellatus* Larvae in Fertilized Ponds

D. D. Lyon and C. Henry (Texas Parks and Wildlife Department, GCCA/CPL Marine Development Center, Corpus Christi, Texas 78418)

The relationship between pH and survival of red drum *Sciaenops ocellatus* larvae in fertilized ponds was examined to determine effects of elevated pH on larval survival at or soon after stocking. Ponds with pH from 8.4 to 9.5 (108 trials) were stocked with 36-h post-hatch red drum larvae. Fish were tempered for 15-25 min before being placed into ponds. Fish were sampled with ichthyoplankton townets. Larval survival was less than 50% in ponds with morning pH $\geq$ 9.0 at time of stocking. This indicates that elevated pH levels in fertilized ponds can reduce survival of red drum larvae. To increase the efficiency of fingerling production for this species, morning pH should be maintained at levels below 9.0 at the time of stocking.

Biomass Size Spectra of Reservoir Fish Communities

G. R. Wilde (Department of Range and Wildlife Management, Texas Tech University, Lubbock, Texas 79409)

Several studies have shown that biomass of plankton communities is uniformly distributed across logarithmically increasing size ranges. Extension of this pattern to higher trophic levels, including planktivorous and piscivorous fishes, is largely based on theoretical considerations and has been tested in relatively few studies. I used cove rotenone data to test two predictions, that total biomass and numbers of organisms are constant over logarithmically increasing biomass ranges. To test these predictions, I used normalized size spectra which, under equilibrium conditions, are expected to have a slope of -1.0. Results from 569 cove rotenone samples, from 107 Texas reservoirs, are in agreement with model predictions. Slopes for the regression of total biomass (r^2= 0.74, P < 0.0001) and number of organisms (r^2= 0.75, P < 0.0001) against mean biomass were -0.95. Deviations from the predicted slope of -1.0 reflect a bias toward larger fish commonly observed in rotenone samples. My results suggest that standing stocks of fishes in one size range (or trophic level) can be predicted based on an estimate of standing crops in smaller or larger size ranges. These predictions can be used to assess the balance of predator-prey relationships or predict the results of introductions.

A Comparison of Electrofishing and Frame Netting for Estimating Size Structure in Bluegill and Redear Sunfish Populations in Texas Reservoirs

J. C. Henson (Texas Parks and Wildlife Department, 1004 E. 26th Street, Bryan, Texas 77803)

Electrofishing and frame netting are commonly used methods for sampling sunfish populations. It is not known whether samples collected by these two methods yield similar estimates of population size structure. Thirty-nine samples of bluegill *Lepomis macrochirus* and 15 samples of redear sunfish *L. microlophus* collected from Texas were compared to evaluate differences between the two sampling techniques in estimating Proportional Stock Density (PSD). Linear models of the form Electrofishing PSD = a + Frame Net PSD * b were generated for each species using simple linear regression. A significant model with a slope (b) approximately equal to 1 would indicate that the two gear types give similar estimates of PSD. The linear regressions of frame netting PSD on electrofishing PSD yielded a non-significant model for bluegill (F = 0.994, P = 0.3253, b = 0.0897) indicating that the two gear types produce very different estimates of PSD. A significant model was generated for redear sunfish (F = 9.791, P = 0.008, b = 0.2912); however, the very low slope value indicates that PSDs for redear sunfish estimated from frame net samples are consistently higher than those estimated from electrofishing samples. Length frequency histograms showed marked differences in the sample size distributions between the two gear types for both species. In many of the frame net samples, 8- to 13-cm sunfish were not as well represented as in the electrofishing samples, artificially inflating PSD estimates. The data appear to suggest that electrofishing gear samples more efficiently across all size classes than frame nets, generating data that is more reliable for making inferences about population size structure in sunfishes.

Rough Fish and Quality of Fishing for Largemouth Bass

R. W. Drenner (Department of Biology, Texas Christian University, Fort Worth, Texas 76129), C. M. Edwards (Texas Parks and Wildlife Department, 6200 Hatchery Road, Fort Worth, Texas 76114), K. L. Gallo, K. E. Rieger (Department of Biology, Texas Christian University, Fort Worth, Texas 76129), and E. Dibble (U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi 39180)

To examine the effects of "rough fish" on largemouth bass *Micropterus salmoides* and water quality, we conducted a 23-pond experiment at the Eagle Mountain Fish Hatchery. In 1991, all 23 ponds were stocked with fingerling largemouth bass and bluegill *Lepomis macrochirus*. Eleven ponds were stocked with carp *Cyprinus carpio* and gizzard shad *Dorosoma cepedianum* - two species of rough fish which dominate the biomass of reservoir fish communities in Texas. These ponds were fished using artificial lures in 1993 and 1995. We had lower fishing success in ponds with rough fish. Densities of catchable-sized bass (total length, ≥203 mm) were not affected by the presence of rough fish. Higher turbidities in the ponds with rough fish apparently reduced the ability of largemouth bass to locate and attack lures.

Fisherman Catch and the Estimation of the Population Structure of Largemouth Bass and Bluegill in Ponds

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Electrofishing has been the method of choice for fisheries scientists assessing largemouth bass *Micropterus salmoides* and bluegill *Lepomis macrochirus* populations. Yet, owners of small ponds often are unable or unwilling to pay for electrofishing in their ponds. An alternative assessment technique involves examination of fisherman catch data as suggested in "Assessment and Corrective Management for Fish Populations in Small Impoundments" (Texas Chapter of the American Fisheries Society 1985). Unfortunately, no standardized fishing method was given in this publication. Our study provides a repeatable, standardized method of collecting a representative sample of fish in private ponds. Conventional fishing tackle was used to present lures of various size to the fishes (largemouth bass and bluegill) for 30 min for each lure. Angled fish were weighed and measured and the Proportional Stock Density (PSD), Relative Stock Density (RSD), and Relative Weight (Wr) were calculated. Each pond was then electrofished and PSD, RSD, and Wr calculated. Indices calculated from angling data were compared with those from electrofishing.

Evaluation of Different Stocking Densities of Triploid Grass Carp for Control of Aquatic Macrophytes in Texas Panhandle Ponds

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Effective use of triploid grass carp *Ctenopharyngodon idella* for control of aquatic macrophytes requires determination of proper stocking densities. The purpose of this research was to evaluate three stocking densities of triploid grass carp for control of aquatic macrophytes in ponds of the Texas panhandle. Triploid grass carp were stocked in ponds with macrophyte coverage ranging from 0 to 100%. For each pond, percent macrophyte coverage was estimated monthly along permanent transects with a recording fathometer. Macrophyte community composition, water transparency, and water temperature were also monitored monthly throughout this research. From March 1991 to September 1992, macrophyte coverage decreased 2% in ponds stocked with 25 fish/hectare (vegetated), 21.4% in ponds stocked with 50 fish/hectare (vegetated), and 100% in ponds stocked with 75 fish/hectare (vegetated). Aquatic macrophytes were eliminated in 12 months from ponds stocked with 75 fish/hectare (vegetated). Triploid grass carp stocked at 25 fish/hectare did not allow regrowth of vegetation in ponds that were previously treated with herbicides. Water transparency remained the same in ponds stocked with 25 fish/hectare (vegetated), decreased 1.0% in ponds stocked with 50 fish/hectare (vegetated), and decreased 58.1% in ponds stocked with 75 fish/hectare (vegetated).

Growth, Fishing, and Natural Mortalities of Crappies in Two Mississippi Lakes

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Growth and mortality rates were estimated for crappie populations in Columbus Lake and Lake Beulah, Mississippi, 1993-1994. Exploitation was estimated from tags returned by anglers and total annual mortality with catch curve analyses. Mortality estimates were adjusted for handling mortality, tag loss, and non-reporting. Growth rates were determined by analyzing white crappie scales from Columbus Lake and black crappie scales from Lake Beulah. Exploitation was the major component of the total mortality of crappie in Columbus Lake, whereas natural mortality was the major component of mortality of populations in Lake Beulah. Harvest regulations should benefit the crappie population in Columbus Lake but are not warranted on Lake Beulah. Growth rates of both crappie populations are similar to rates reported in other populations. Growth on Columbus Lake is adequate to support a minimum length limit.

Fish Stocks at Risk in Texas

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The Fish Stocks at Risk Committee was formed by the Texas Chapter of the American Fisheries Society to provide insight on fishes that may become endangered and to better anticipate solutions to problems before they become critical. There are already 29 threatened and endangered fishes recognized by the state of Texas. Protection of these listed species is not only expensive, but typically is indicative of larger environmental problems. These types of problems tend to be easier to resolve in their formative stages and become progressively more difficult and controversial as they progress. Stocks that are at risk and eventually will require listing if trends continue include: the shovelnose sturgeon *Scaphirhynchus platorynchus* population in the Rio Grande, west Mexican redhorse *Moxostoma austrinum*, the Rio Grande population of blue catfish *Ictalurus furcatus*, Texas bluegill *Lepomis macrochirus macrochirus* and *L. m. speciosus*, native Texas largemouth bass *Micropterus salmoides salmoides*, and the Guadalupe bass *Micropterus treculi*.

Establishing Native Macrophytes for Fish Habitat in North Texas Reservoirs

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Many north Texas reservoirs are characterized by turbid waters and few aquatic macrophytes. Recently, however, many previously unvegetated reservoirs have been invaded by the aggressive, exotic species hydrilla *Hydrilla verticillata*. Unfortunately, the short-lived benefits of diversified habitat and improved water clarity during early stages of hydrilla infestations are negated by long-term management and ecological problems. Native species, in contrast, offer habitat and water quality benefits with few long-term management problems. While a diverse native plant community is usually desirable, there are few management tools aimed at developing one. This presentation reviews ecological considerations for environmental restoration utilizing native aquatic plants and presents results of research-scale efforts to establish native plants in two north Texas reservoirs. Lake Lewisville is a large mainstem reservoir with turbid water, few aquatic plant species, and an annual water fluctuation of about 3 m. Founder colonies of water star grass *Heranthera dubia* and American pondweed *Potamogeton nodosus*, two native pioneer species, were established within protective exclosures in the Lake. After 1 year of growth 50% or more of the colonies had survived. North Lake is a small cooling-water reservoir with muted water level fluctuations, clear water, and a history of extensive hydrilla infestation. Following a successful herbicide treatment for hydrilla in 1992, the lake showed a strong re-growth of several native pioneer species. Nine protected colonies of vallisneria *Vallisneria americana*, a desirable higher-successional plant, were established within the lake. After a year of growth, seven colonies still survived and many had expanded to fill the entire protective exclosure. However, selective herbivory on this highly-desirable plant species appears to be a major deterrent to continued expansion. This research will contribute to our ability to more effectively manage reservoir fisheries by providing enhanced fish habitat.

A Comparison of Juvenile and Forage Fish Occurrence Among Natural, Rip-rapped, and Bulkheaded Shoreline Habitats in Lake Conroe, Texas

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Shallow water areas function as a transition zone between the shoreline and deeper water, providing cover and nursery and feeding habitats for juvenile and small forage fish. Bulkheads constructed below a reservoir's mean pool level can partially or completely eliminate this shallow water zone. In addition, many controlling authorities in Texas require that fill placed behind these bulkheads be obtained by dredging within the lake, resulting in additional loss of shallow water habitat. In waters of the U.S., bulkhead construction involving dredging and filling requires a permit from the U.S. Army Corps of Engineers. The majority of these permits are granted with little or no compensation required for fish habitat loss. The Texas Parks and Wildlife Department, in response to the continued authorization of permits for construction of bulkheads below the mean pool level, conducted this study to quantitatively address potential detrimental effects to fish habitat. Our study was conducted at Lake Conroe, Texas--a reservoir heavily affected by bulkheading. We electrofished three shoreline types (natural, rip-rapped, and bulkheaded) for 5 min each at three separate sites. Sites were sampled on a seasonal basis (fall, winter, spring, and summer). Our results indicate that approximately three to four times as many juvenile fish and adult small forage fish were found associated with natural and rip-rapped shorelines than with bulkheaded shoreline. Based on these results, the Texas Parks and Wildlife Department requested rip-rap be used as mitigation for habitat loss due to bulkhead construction. In response to this request, the local district of the U.S. Army Corps of Engineers has initiated changes in its bulkhead permit requirements.

Retention of Coded Wire Tags Injected into Four Locations in Juvenile Paddlefish

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To compare the practicality of tagging paddlefish *Polyodon spathula* in rostral and non-rostral locations, we injected juvenile paddlefish (total length, 180-240 mm) with coded wire tags in either the (1) ventral mid-rostrum, (2) tip of rostrum, (3) skin between the rays of the dorsal fin, or (4) opercular flap. Injection into locations 3 or 4 took about three times as long as the rostral locations. After 7 months of culture in circular tanks, and accounting for the 37% overall mortality, retention was 88% in location 1, 71% in location 2, 45% in location 3, and 51% in location 4. Although tag retention was adequate in any location, we feel that injection into the latter two locations required too much skill and time to be useful for tagging more than several hundred fish.

Evaluation of a 407-mm Minimum Length Limit for Walleye in Lake Meredith Reservoir, Texas

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Walleye *Stizostedion vitreum* were stocked in Meredith Reservoir, Texas in 1965 and established a self-sustaining population. A statewide 407-mm length limit was imposed in September 1987. Prior to this there were no length limit regulations for walleye. Published information on walleye length limit regulations often had conflicting conclusions. The objective of this study was to determine the effects of a 407-mm length limit on walleye recruitment, growth, population structure, and angler catch rate and harvest. Recruitment and population data were collected by gill nets. Age and growth was determined through analysis of scale and otolith samples. Angler utilization and harvest statistics were determined through creel surveys. Study results indicated the length limit significantly increased Age 1 (304 mm) recruitment. Growth rate of Age 1 and Age 5 walleye significantly declined but fish still reach legal size by Age 4. The length limit resulted in increased total abundance and abundance of legal size walleye. There was no increase in PSD or RSD as all size classes increased at approximately the same rate. Creel data indicated the length limit reduced total catch rate, harvest rate, and yield (kg/ha) in 1988. Total catch rate was double the pre-regulation rate by 1990 and continued to increase to a high of 0.27 fish/ha, more than triple pre-regulation rates, by 1995. Both harvest and yield increased but the increases were not significant. The 407-mm length limit successfully increased the abundance of the walleye, increased the abundance of legal size walleye, increased available brood stock, and increased angler catch and harvest rates. Results indicate studies of walleye length limits require adequate evaluation periods.

Poster Session Abstracts

Effects of Temperature and Salinity on Early Life History Stages of Yellowtail Snapper *Ocyurus chrysurus*

E. W. Curtis and G. J. Holt (Department of Marine Science, The University of Texas at Austin, Port Aransas, Texas 78373)

Effects of temperature and salinity on laboratory-spawned yellowtail snapper *Ocyurus chrysurus* eggs and yolk-sac larvae were investigated by examining incubation period, hatch rate, survival to yolk exhaustion, and size at hatch and yolk exhaustion. Temperature and salinity treatments ranged from 20 to 32°C and 25 to 45 ppt, respectively. Incubation period decreased with increasing temperatures while low salinity increased survival to yolk exhaustion. Larvae cultured below 26°C were larger at yolk exhaustion than larvae from all other temperature treatments. Salinity treatments produced no differences in standard length. With these results, we hope to optimize hatch rate, survival, and growth which will ultimately aid in production of juvenile and adult yellowtail snapper.

Investigation of Factors That May Affect Inter-Laboratory Calibration of the RNA:DNA Ratio of Larval Fish

K. C. Drescher and G. J. Holt (Department of Marine Science, The University of Texas at Austin, Port Aransas, Texas 78373)

Modifications to a RNA:DNA technique used for interpretation of nutritional condition of larval fish were evaluated to determine the effects of delay of sample freezing, cryopreservation, diel cycling, and tissue preparation on red drum *Sciaenops ocellatus*. Increasing the length of time a postmortem larva was exposed to room temperatures before freezing did not significantly affect the RNA content, DNA content or RNA:DNA ratio. Extended freezing of eggs and larvae did not affect the RNA:DNA ratio, RNA content, or DNA content for up to 8 months for eggs or 60 d for larvae. The tissue type used in the protocol significantly affected the RNA:DNA ratios for the same fish. The average RNA:DNA ratio of whole fish (standard length, 6-10 mm) was 5.770, 70% less than the average RNA:DNA ratio of 19.539 for the epaxial muscle portion. Diel variations in RNA:DNA ratio were undetectable when whole fish were analyzed.

Scanning with Acrobat Capture

J. T. Davis and K. Jefferson (Extension Wildlife and Fisheries, Texas A&M University, College Station, Texas 77843-2258)

Acrobat Capture is a software package that converts printed pages to various electronic formats, in particular, Portable Document Format (PDF). Before the development of Capture, optical recognition characters (OCR) and graphic scanning were separate entities. Capture combines these two and retains the same graphics and page structure of the original document. This saves time and results in a product that is easier to transfer electronically.

Aquatic Plant Identification Field Guide

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The Aquatic Plant Identification Field Guide is designed to allow the user to have visual access to commonly seen aquatic plants in Texas without actually being outdoors. Over 50 aquatic plants with vivid color images, detailed line drawings, and descriptions which emphasizes distinguishable characteristics are featured in this field guide. For a simple or multi-faceted product, cost, equipment, and production are essential elements that must be considered before implementation of any other processes.

Acknowledgments

The work and contributions of the abstract authors, the Editorial Committee (Gordon Linam, Rebecca Hensley, Gene Wilde, Reynaldo Patiño, and Bob Edwards), John Moczygemba (Awards Committee), and Rick Ott and Jody Williams (Publicity Committee) in the preparation of this Proceedings is much appreciated.

The entire Chapter is grateful to the over 40 contributors who donated auctionable and raffleable goods, money, and services for the 1995 Annual Meeting in College Station.

Citation:

Author(s). 1996. Title. Pages ____ *in* J. N. Fries, editor. Annual Proceedings of the Texas Chapter, American Fisheries Society, Volume 18. Texas Chapter, American Fisheries Society, Austin, Texas.

ISSN 1060-2224