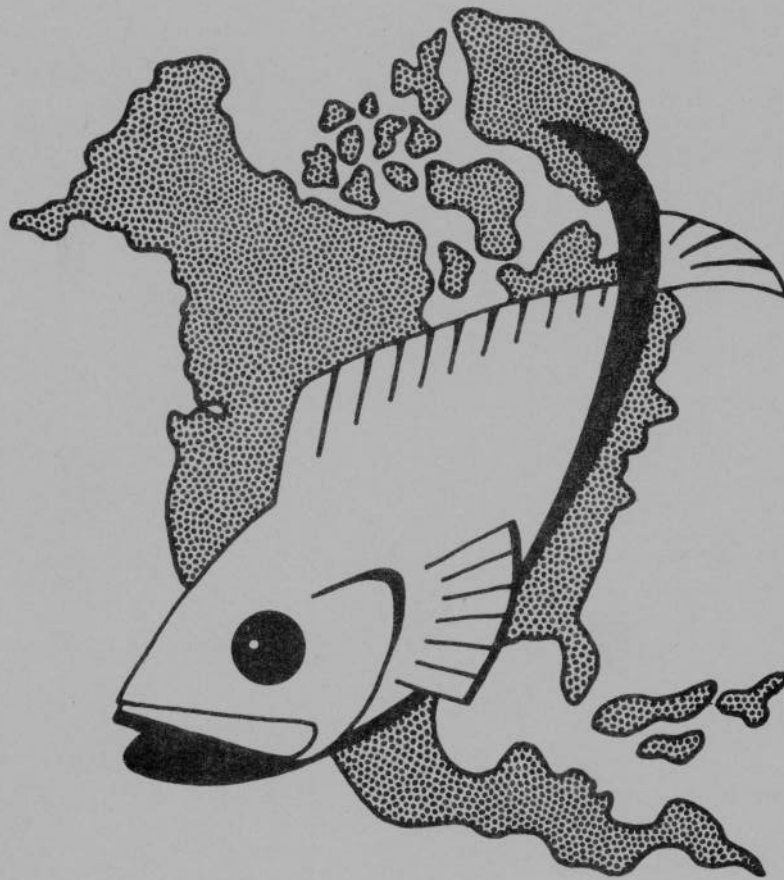


ANNUAL PROCEEDINGS  
of the  
TEXAS CHAPTER  
**AMERICAN FISHERIES SOCIETY**



Ingram, Texas  
September 24-25, 1993

**VOLUME 15**

TEXAS CHAPTER  
AMERICAN FISHERIES SOCIETY

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

MEMBERSHIP

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

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

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

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

**September 24 and 25, 1992**

**Ingram, Texas**

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**1993**

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## CONTRIBUTORS

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### CONTRIBUTORS

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## 1992 TEXAS CHAPTER AWARDS

### Outstanding Fisheries Worker of the Year

The award in the category of **Management** went to **Ken Sellers** (TPWD). Ken was recognized for his work promoting youth fishing in the Waco area and for helping to provide angling opportunities to the physically and mentally challenged. He was also involved in identifying and reducing pollution in the Bosque River, aided the Army Corps of Engineers in the Stillhouse Hollow Habitat Improvement Project, published in the TPWD Management Data Series, the Southeastern Association of Fish and Wildlife Agencies and in the TPWD Magazine.

The award in the category of **Research** went to **Bob Colura** (TPWD). Bob has been a leader in efforts by the TPWD to develop methods for spawning and culturing spotted seatrout on a production basis. He has conducted research to determine which conditions in culture ponds have the most influence on spotted seatrout survival. He has also developed statistical models, using growth rates and morphometrics, for differentiation between spotted seatrout from different bay systems in Texas. Bob wrote a chapter on the culture of red drum for the CRC Handbook of Mariculture and is currently conducting research on possible differences in growth rates of spotted seatrout among bay systems.

The award in the category of **Education** went to **Brian Murphy** (TAMU). Brian has been a professor of fisheries in Texas since coming to Texas Tech in 1980. He moved to Texas A&M University in 1985 as an Associate Professor in the Department of Wildlife and Fisheries Sciences. He has primary responsibility for teaching graduate courses in fisheries ecology and management and has taught five different courses with a teaching load of two courses per semester. In addition, he serves as Associate Head for Research and Graduate Programs in the department. During his career he has directed 13 students to completion of Master's degrees and two Ph.D. degrees. At present he has five M.S. candidates and 2 Ph.D. candidates. He also works closely with the AFS student chapter, advises graduate and undergraduate students and conducts research on recreational fisheries in impoundments.

The award in the category of **Culture** went to **Camilo Chavez, Jr.** (TPWD). Camilo has worked for TPWD for the past six years as a technician, biologist or hatchery superintendent at Corpus Christi, Jasper and now at the Dow facility. He actively participated in the culture and stocking of millions of marine and freshwater fishes during his career. In 1992, he excelled in fish production at the Dow Hatchery. The previous record of 7.5 million red drum fingerlings in 1990 has now been broken. The 1992 spring and summer production of red drum is already at 9 million fingerlings and the fall production is still to come.

A **Special Recognition** award was given to **Bobby Farquhar** (TPWD). This honor was bestowed on Bobby for his years of service to the Texas Chapter of the American Fisheries Society and to the anglers of Texas. He was instrumental in working on the pond management committee and assisted with producing the pond stocking and assessment manual. He has served as president of the Texas Chapter, spear-headed t-shirt sales and is current chairman of the urban fishing committee. In regards to service to the anglers of Texas, Bobby played a key role in initiating TPWD's Volunteer Angler Program, his idea on fish lake record recognition has grown into TPWD's Angler Recognition Program and the need to inform the angler about this state's fishing opportunities prompted him to co-author a book containing fishing information and maps on 133 reservoirs in Texas.

#### Outstanding Presentation

**Maurice Muoneke** of the Texas Parks and Wildlife Department received the award for Outstanding Presentation at the 1992 Annual Meeting for his paper entitled "White Bass Exploitation in the Brazos River System, Texas".

## HISTORY OF TEXAS CHAPTER AWARDS

- 1977 Fisheries Research - John A. Prentice and Richard D. Clark, Jr. (TPWD)
- 1978 Fisheries Education and Research - Clark Hubbs (UT)  
Fish Culture - Pat L. Hutson (TPWD)  
Special Recognition - Edward R. Lyles (FWS)
- 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 Fisheries Education - Bobby Whiteside (SWTSU)
- 1982 Fish Culture - Roger L. McCabe (TPWD)  
Fisheries Research - William C. Guest (TPWD)  
Special Recognition - Robert P. Hofstetter (TPWD)
- 1983 Special Recognition - Robert J. Kemp (TPWD)
- 1984 none
- 1985 Fisheries Education - Donald E. Wohlschlag (UTMSI)  
Fisheries Research - Connie R. Arnold (UTMSI)
- 1986 Fisheries Management - William Higginbotham (TAES)  
Fisheries Research - Robert L. Colura (TPWD)
- 1987 Fish Culture - Kerry Graves (FWS)  
Special Recognition - The Sportsmen's Club of Texas
- 1988 Fisheries Research - Gary P. Garrett (TPWD)  
Special Recognition - Kirk Strawn (TAMU)
- 1989 Fisheries Administration - Gary C. Matlock (TPWD)  
Fish Culture - Robert R. Vega (TPWD)  
Fisheries Management - Joseph E. Kraai (TPWD)  
Fisheries Research - Roy J. Kleinsasser and Gordon W. Linam (TPWD)
- 1990 Fisheries Administration - C. Gene McCarty (TPWD)  
Fish Culture - Glen A. Alexander and David L. Campbell (TPWD)  
Fisheries Management - David R. Terre (TPWD)
- 1991 Fisheries Administration - Pat L. Hutson (TPWD)  
Fish Culture - Jake Isaac, Jr. (TPWD)  
Fisheries Management - Mark Webb (TPWD)  
Fisheries Research - Ronnie M. Pitman (TPWD)  
Special Recognition - The Wetland Habitat Alliance of Texas

## TEXAS CHAPTER AWARDS CRITERIA

A total of seven awards may be presented on an annual basis, assuming nominations are received. 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 in any or all areas. If multiple nominations are received and more than one nominee is considered outstanding, then honorable mention awards 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 five specialization categories: Administration, Culture, Education, Management, and Research. 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. The presentation must not be on data presented elsewhere.
- d. 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. Scientific and research value - 20 points
- b. Management value - 15 points
- c. Scope - 10 points
- d. Verbal presentation - 20 points
- e. Audio-visual presentation - 15 points
- f. Conciseness and clarity - 10 points
- g. Intelligent discussion stimulated - 5 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 either on cumulative point totals or relative rankings.

## TOTAL LIPID AND FATTY ACID REQUIREMENTS OF RED DRUM LARVAE (*SCIAENOPS OCELLATUS*)

by

Robin Brinkmeyer and G. Joan Holt  
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*Marine Science Institute*  
*P.O. Box 1267*  
*Port Aransas, Texas 78373-1267*

**Abstract** - The role of marine lipids in fish nutrition is of much interest to aquaculture in relation to improved growth rate and product quality. In this study, the total dietary lipid and dietary n-3:n-6 fatty acid ratio requirements of red drum *Sciaenops ocellatus* larvae were investigated. Larvae were reared from first feeding to 18 days using a feeding protocol that combined an artificial diet with live prey (rotifers). Microparticulate, semi-purified diets were formulated with varied levels (13, 18, 23, and 28%) of total lipid (menhaden oil). Mean standard length of day-18 larvae fed a diet containing 18% total lipid was significantly greater ( $P=0.0001$ ) in repeated feeding trials. There was no significant difference in survival or final weight among diets. Preliminary feeding trials using diets formulated with varied n-3:n-6 fatty acid ratios indicate improved growth in larvae fed a diet containing a 10:1 ratio as compared with 1:1, 5:1 and 15:1.

**PRELIMINARY RESULTS OF A STUDY OF SPAWNING SUCCESS OF  
FORAGE-FED VS. PELLET-FED FLORIDA LARGEMOUTH BASS**

by

Gordon Garwood and Thomas M. Brandt  
U.S. Fish and Wildlife Service  
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San Marcos, Texas 78666

and

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Aquatic Station, Biology Department  
Southwest Texas State University  
San Marcos, Texas 78666

**Abstract** - To determine the effect of diet on Florida largemouth bass *Micropterus salmoides floridanus* broodstock performance, 150, 1990 year-class (170-300 g) fish were stocked into each of six 0.04-hectare ponds during October of 1991 and fed live goldfish or one of five experimental pelleted feeds. In February, 1992, the fish were sexed and males and females placed in 12 separate ponds. Starting in late March, four pairs of largemouth bass from each of the six treatments were placed in separate 0.6- x 1.5- x 4.5-m raceway sections with a 95 L/min flow and allowed to spawn over a 16-d period. In each raceway section, a Spawntex mat was placed and checked for eggs twice daily. Mats with eggs were left in the raceway for 24 h, then were moved to hatching tanks and the resulting fry were counted. Using different pairs of fish, the 16-d spawning period was repeated in April and May. Production during the first spawning period ranged from the equivalents of 10,500 to 30,000 fry/kg female body weight (BW). Forage-fed fish produced six spawns which totaled the kg BW equivalent of 70,000 fry, and pellet-fed fish produced one spawn (10,500 fry/kg BW). In the second period, production dropped to 2,000 to 7,000 fry/kg BW with forage-fed fish producing only one spawn (5,000 fry/kg BW) and pellet-fed fish had seven spawns which totaled the kg BW equivalent of 22,000 fry. In the third period, spawns ranged from <100 to 11,000 fry/kg BW with only one spawn from a forage-fed pair (1,700 fry/kg BW) and pellet-fed fish produced seven spawns which totaled the kg BW equivalent of 29,000 fry. Further analyses are being performed.

**A COMPARISON BETWEEN COTTONSEED MEAL AND CORNMEAL  
ORGANIC FERTILIZERS IN LINED HATCHERY GROWOUT PONDS**

by

Steven C. Hamby, Loraine T. Fries,  
Mark A. Stacell, and Clarence W. Bowling  
*A.E. Wood State Fish Hatchery  
Texas Parks and Wildlife Department  
San Marcos, Texas 78667*

**Abstract** - At the A. E. Wood State Fish Hatchery in San Marcos, Texas, elevated afternoon pH levels in lined ponds fertilized with cottonseed meal prompted an investigation into alternative organic fertilizers. A comparison of ponds fertilized with and without additions of cornmeal was initiated in Florida largemouth bass *Micropterus salmoides floridanus* fry rearing ponds. Experimental and control ponds were fertilized with cottonseed meal and inorganic fertilizers, with the experimental ponds receiving additions of cornmeal. Experimental ponds maintained significantly lower pH levels than control ponds, despite having higher chlorophyll-a levels. Additionally, experimental ponds had increased zooplankton populations. Florida largemouth bass percent survival was similar in both treatments, but mean fish length was greater in experimental ponds. These results suggest that the addition of cornmeal may aid in reducing pH in hatchery ponds as well as having favorable effects on fingerling production.

## STRIPED BASS HOOKING MORTALITY

by

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and

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4200 Smith School Road  
Austin, Texas 78744

**Abstract** - We investigated mortality of striped bass *Morone saxatilis*, within a length range of 229 - 762 mm total length, caught with artificial lures with a single hook, artificial lures with treble hook(s), and live bait with a single hook. Striped bass ( $N=307$ ) were caught during a 2-year period in Lake Texoma starting June 1989 and concluding June 1991. Captured fish were measured, fin-punched for identification, and transported to a net pen in the lake and held 72 h. Overall hooking mortality was 38%. Hooking mortality was significantly ( $P<0.05$ ) related to fish length, season, and bait type. There was a direct relationship between fish length and hooking mortality, and a predictive model for hooking mortality was developed. Hooking mortality was higher in spring (69%) and summer (47%) than in fall (8%) and winter (13%). Hooking mortality (58%) was significantly higher when live bait was used.

## WHITE BASS EXPLOITATION IN THE BRAZOS RIVER SYSTEM, TEXAS

by

Maurice I. Muoneke  
Texas Parks and Wildlife Department  
4200 Smith School Road  
Austin, Texas 78744

**Abstract** - Dynamics of a heavily exploited white bass *Morone chrysops* population were assessed in the Brazos River and Lake Whitney, Texas. Fish averaging 338 mm total length (TL) were collected by electroshocking and tagged with Floy FD-68BC anchor tags during spawning migrations in March 1988 ( $N = 1,550$ ), 1989 ( $N = 514$ ), and 1990 ( $N = 1,069$ ). In September 1988, 254-mm TL minimum and 25-fish daily bag limits were placed on the previously unregulated fishery. Rewards of \$5, \$10, \$20, \$50, or \$100 were offered for tags returned from each fish. Angling exploitation was highly seasonal; more than 92% of the first-year tag returns were reported within 112 days of tagging. Eighty-eight percent of the tag returns were reported the same year fish were tagged and 10% were reported the following year. Annual angler exploitation, calculated from angler tag returns and corrected for tag loss was 0.59, 0.35, and 0.34 from 1988-1990, respectively. Estimated total mortality was highest (0.96) in 1988 but declined to 0.74 in 1990. Mean TL of young-of-year white bass collected in October through December was 237 mm. These fish were not recruited into the sport fishery until their second year of life. Recruitment that year was under 5% during May, increasing to about 10% in July and by October, more than 50% of the cohort had been recruited.

**COMPARISON OF DEMOGRAPHIC CHARACTERISTICS,  
ATTITUDES, AND MANAGEMENT PREFERENCES OF  
TOURNAMENT AND NON-TOURNAMENT BLACK BASS ANGLERS  
IN TEXAS**

by

Robin K. Riechers and Gene R. Wilde  
*Texas Parks and Wildlife Department  
4200 Smith School Road  
Austin, Texas 78744*

Robert B. Ditton and Mark Fisher  
*Department of Wildlife and Fisheries Sciences  
Texas A&M University  
College Station, Texas 77844*

**Abstract** - We conducted a mail survey of largemouth bass *Micropterus salmoides* anglers in Texas during February and March of 1992. The sampling frame consisted of 1,965 respondents to a 1991 statewide survey of Texas licensed anglers who indicated that largemouth bass was the species they most preferred to fish for in Texas fresh waters. The survey instrument was a 47-question, self-administered questionnaire that sought information on demographic, economic, and social characteristics of largemouth bass anglers. We also asked anglers whether they participated in freshwater fishing tournaments. Responses to this question were used to identify respondents as tournament ( $N=188$ ) and non-tournament ( $N=871$ ) black bass anglers. On average, tournament anglers were older (44 versus 39 years), more avid (40 versus 19 days fished in 1991), and more likely to belong to fishing clubs (35 versus 5%) than were non-tournament anglers. Tournament anglers were generally more supportive of management alternatives than were non-tournament anglers, but were less likely to support initiation of a tournament permitting system (41 versus 64%). Overall, the preferences of bass tournament anglers reflect their interest in management measures that allow them to catch trophy-size fish; non-tournament anglers have more general experience requirements and management preferences.

## STATISTICAL MODELS FOR ANALYSIS OF GILL NET DATA

by

Gene R. Wilde  
*Texas Parks and Wildlife Department*  
4200 Smith School Road  
Austin, Texas 78744

**Abstract** - Gill net catches of pelagic fish species commonly exhibit a negative binomial distribution (NBD). Properties of the NBD can be used to develop two types of statistical models for analysis of gill net data. First, a sampling process for gill nets based on the NBD can be proposed that allows resolution of gill net catches into two general measures of fish abundance: 1) school abundance, and 2) school size. School abundance is measured as the mean number of nets in a standard complement that capture fish. School size can be estimated in several ways; however, simulation studies suggest the best measure is the mean number of fish per non-zero net, adjusted by the estimated number of schools that encountered nets. These indices allow detection of temporal and spatial patterns in fish abundance that can not be detected with more commonly used summary statistics such as catch per unit effort or mean catch per net. Second, generalized linear models (GLMs) can be constructed to model gill net catch as a NBD. Advantages of GLMs over the usual approach of transforming catch data and using Normal theory models include: 1) parameters (e.g., regression coefficients) are estimated with greater precision and efficiency; 2) predicted values are restricted to  $\geq 0$ ; and 3) because GLMs operate on the untransformed data, predicted values require no back-transformation and represent means, rather than medians, on the original scale of measurement.

**SAMCALC: A COMPUTER PROGRAM FOR FISH CULTURISTS**

by

**Joe N. Fries**

*U.S. Fish and Wildlife Service  
National Fish Hatchery and Technology Center  
500 East McCarty Lane  
San Marcos, Texas 78666*

**Abstract** - Many fish culture operations require calculations, some of which can be wasteful or even fatal to the fish if a decimal is misplaced. SAMCALC (previously FISHCALC) is a user-friendly, free computer program which can help fish culturists with calculations for fish transport, chemical treatments, length-weight relations, injections, and oxygen solubility. The program also has several statistical modules, including a contingency table, analysis of variance, and experimental design. SAMCALC should be ready for distribution by December 1992.

## EFFECT OF CONTAMINATION ON FISHERIES RESOURCES

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Contaminants can cause a variety of problems, ranging from direct toxicity to long-term accumulation. This can affect everything from the viability of a fishery to human health problems.

There are approximately 80,000 river miles in Texas in 23 river basins. We have more than 5,700 reservoirs in the state. Slightly less than 2,000 square miles of coastal bays lie along our 367 miles of gulf coast. Eight major and 16 minor aquifers underlie 75% of the state's surface. Obviously, aquatic habitat is a major part of Texas.

In 1989, Texas ranked first in the nation in total releases and transfers of toxic chemicals. It ranked first in air releases of toxic chemicals, in deep-well injection of toxic chemicals, and in releases of carcinogens. The petrochemical industry in Texas accounted for approximately 88% of total toxic releases in 1989.

However, the picture is not all bad. Ninety-nine percent of Texas surface waters met the fishable, swimmable goals of the Clean Water Act. Of the 1% that did not, 65% of the stream miles were downstream of major population centers. On the other hand, 23% of our bay waters are closed to shellfish harvest due to fecal coliform contamination.

Texas ranks very high with sportsmen in the United States as a place to go fishing. Because commercial and recreational fishing is an important industry for Texas, we need to be able to answer the basic question "are the fish safe to eat?". Unfortunately, contaminant studies are very expensive. Typically, costs range from \$50 to \$1,000 per sample. No state or federal agency is conducting widespread contaminant studies in Texas. Other states, such as Oklahoma, Missouri and Maryland, are conducting these types of studies, financed by federal or state funds. The lack of funding here in Texas results in our studies only taking place in known problem areas or where we know there is a potential for problems. The few studies that are taking place are often not well coordinated. In an effort to improved this situation, the Texas Legislature formed the Texas Toxic Substances Coordination Committee. It is chaired by the Health Department, members include Texas Parks and Wildlife Department, Texas Department of Agriculture, Texas Water Commission and the Air Control Board. They formed a subcommittee specifically to address fisheries issues. Unfortunately, even this committee will not be able to develop a statewide contaminant monitoring program. State and federal agencies need to work together to develop one. Fisheries management programs need information on the extent of contaminants in the state.

We need to get out the good news as well as the bad, so that we do not unnecessarily scare people away from using fishery resources. We are trying to get baseline data on minimally impacted areas. Until we can get adequate funding for comprehensive, coordinated studies, all those who are interested and are conducting

contaminant studies should share information so that we all can make well-informed decisions and address problems.

## **BIODIVERSITY IN THE REALM OF FISHERIES RESOURCES**

Richard O. Anderson  
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Effective management of our natural resources will always be a challenge and a responsibility. Part of the challenge today is changing perspectives and philosophies. A new goal of preservation of biodiversity has been adopted by federal agencies including the Fish and Wildlife Service (FWS), Bureau of Land Management and the Soil Conservation Service. For many years the mission of the FWS was to "conserve, protect and enhance fish and wildlife and their habitat for the continuing benefit of people." The mission adopted in 1991 was to "achieve a national net gain of fish and wildlife and the natural systems which support them"; preservation of biological diversity was adopted as the underlying philosophy against which all actions and activities are evaluated. Traditional programs for public benefit such as fishery management and hatcheries have been reduced.

One definition of biodiversity is the full variety of life and its associated patterns and processes. Preservation of the variety of life aims at protection of rare and endangered species and their critical habitats. The associated patterns and processes of populations, communities and ecosystems reflect their biological integrity. Processes including reproduction, recruitment, growth and mortality determine annual production and structural patterns such as standing crop and length-frequency distribution; patterns of relative weight and relative gonad weight reflect food and feeding conditions. These patterns reflect the biointegrity of populations, communities and ecosystems.

What should be our goals and objectives in management of fisheries and aquatic ecosystems? Bluegill in Mid Lake, Wisconsin have a greater potential for growth in lentic environments than those in Texas. They do not mature until 2-3 years old and females do not spawn until 5 inches long. Contrast that to the bluegill that evolved in small streams and ephemeral habitats of Texas; native female bluegill mature in one year at 2 inches long. Should the northern bluegill be part of Texas management programs for lakes and ponds, or should we live with the native Texas bluegill? How do we balance the goal of preservation of biodiversity with a goal of enhanced biointegrity and public benefit? Such questions must be considered in looking at the future of fisheries in Texas.

## BIOPOLITICS - POLITICAL IMPACTS ON BIOLOGICAL ISSUES

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*Resource Protection Division*  
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 Austin, Texas 78744

More and more, biology and politics get mixed and sometimes not too well. It is getting increasingly difficult for biologists and managers to do their jobs. In the past not many people cared that much or paid that much attention to what we did. But, it is not the case anymore. Our actions are increasingly scrutinized by others. Here are some reasons why:

- 1) Development of the environmental movement. The top 20 environmental groups have a total membership of 7.7 million, a combined annual budget of \$539,000,000 and a total staff of 3,800. They are watching us and industry is watching them and us; and everyone seems to be looking over their shoulder.
- 2) Growing realization that we are losing a lot of the protective buffers of our fisheries resources. The environment surrounding these resources is increasingly stressed and is less able to absorb abuse and rebound from it. It is not enough to look at year classes and catch rates of fishes. We have to look at where they live. We have already lost about half of our most valuable habitats. In those that remain, we must be concerned about habitat quality. Resource Protection Division staff looks at approximately 2,000 permits per year regarding freshwater discharge. We review 100 - 200 water diversion projects per year. We investigate almost 300 fish kills per year. The permitting process is one of the most common meeting grounds of politics and biology.
- 3) State and federal laws. More and more biological issues are being brought into law (e.g., Endangered Species Act, Clean Water Act, Natural Resources Damage Assessment Act). All are directed at addressing biological issues and putting them in a legal or legislative framework.

What this means is that when biological issues are addressed in a public forum they are going to be mixed in a very politically charged atmosphere. We biologists must be able to function in that arena in a responsible and effective way. If we can not, our research and management efforts will come to nothing. The problem is how do we biologists participate responsibly and effectively in that political arena? Before we get to that answer, you need some background on the rules of the game:

- 1) First, there are no rules in politics. Today's ally may be tomorrow's opponent, particularly when the issues change.
- 2) Politics are generally focused on short-term problems and solutions. Biological issues are generally long-term. This does not mix well.
- 3) Government does not like to address problems until they become a crisis (e.g., public school funding, prisons, the Edward Aquifer issue). When the

- issue finally gets attention, it has to be answered immediately or better yet, postponed to some time in the future.
- 4) Resource concerns generally start off in a position of compromise and go downhill from there. It is difficult for biologists to do anything else. Although it may be an effective negotiating tactic, you can not start with a more extreme position that can not be supported.
  - 5) Many people have very good intentions but, they are not willing to pay the necessary price. They may support an environmental philosophy, but not if it affects their project.
  - 6) All tactics are fair. When environmental issues get in the way of "progress", debate on merits is the least concern (e.g., wetlands definition debate, Endangered Species Act).
  - 7) Time waits for no man, or woman. Political decisions will be made whether we biologists get involved or not.
  - 8) No punches are pulled if the opportunity becomes available.
  - 9) Sometimes you win and sometimes you lose. You have to develop the attitude that you can live with this fact. Do what you can do and work within the system for the long haul. Otherwise, everything is stacked against you.
  - 10) No good deed goes unpunished. It takes a thick skin for a biologist to deal in a political situation. Even when you are "right". If you leave any opening for the other side they will exploit it, no matter how petty, as a means of distracting from the real issue.

How can we as biologists survive in a system like this? First, it is not as bad as all these examples would make it seem. Most of the time, the people you deal with are very reasonable and things go smoothly. It is just those few difficult ones that we tend to focus on. Also, remember we do have several very powerful allies such as the Texas Parks and Wildlife Commissioners, and individuals like Ed Cox and Perry Bass to name just a few. When the going gets tough, its good to have tough on your side!

The most important thing for a biologist to do is hold to your principles, go with what you believe and defend it . We are generally not very good at political tactics. For us, consistency and credibility are keys over the long haul. Your decisions and recommendations must be based on the best information available. It is also critical that we are willing to accept that others also have valid opinions. Divide and conquer is a common tactic.

Finally, our working relationship must be one of cooperation among disciplines. We are all in the same boat and often we are surrounded by sharks, thus we must be supportive of each other and work together.

## THE ZEBRA MUSSEL INVASION: A TEXAS CONNECTION?

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**Abstract** - This paper summarizes information on the zebra mussel *Dreissena polymorpha*, an introduced aquatic pest that may eventually invade Texas. Zebra mussels prefer shallow water (2-7 m) with a velocity of 0.15-0.5 m/s, hardness greater than 50 mg/L as CaCO<sub>3</sub>, salinity less than 12 ‰, and temperature in the range of 20-25 °C. They can accumulate in densities up to 800,000/m<sup>2</sup>, alter food webs, increase water clarity, destroy spawning beds, and they have been estimated to have caused up to \$4.2 billion in damages to the Great Lakes area. Most of the waterways of the contiguous United States may be invaded by the zebra mussel. Modes of introduction include waterways, boats, fish-hauling/shipping units, and the aquarium trade. Control methods include predation by fishes and ducks, scraping, anti-biofouling coatings, filtration, heat, drying, electric fields, and pesticides.

The zebra mussel *Dreissena polymorpha* is native to the Black, Caspian, Azov, and Aral seas of Asia (Hebert et al. 1989; O'Neill and MacNeill 1991; Smirnova et al. 1993). It began to spread to Europe via shipping canals in the 1800's (Hebert et al. 1989) and has become firmly established there (O'Neill and MacNeill 1991). The zebra mussel arrived in the United States, probably in ballast water discharge, in 1986 and was first reported in Lake Erie in 1988 (Garton and Haag 1993; Mackie 1993). Currently, this aquatic pest is established in much of the Great Lakes area (Garton and Haag 1993), is spreading rapidly, and may eventually invade Texas. This paper summarizes information on zebra mussels that should be helpful in planning for the pest's arrival.

### Identification

Zebra mussels are small bivalve mollusks that, as adults, look like "D-shaped" clams. Mature mussels typically have black or brown bands separated by lightly colored bands but occasionally have only one dark band or are not banded at all (Figure 1)(Marsden 1991; Morton 1993). They usually are about 25 mm long (Hebert et al. 1989) but can grow to 40 mm (Marsden 1991). The zebra mussel is the only North American freshwater mussel that, as an adult, securely attaches itself to solid objects, including rocks, boats, pipes, crayfish, and even each other (Hebert et al. 1989; MacIsaac et al. 1991).

Another mussel, the dark false mussel *Mytilopsis leucophaeta*, closely resembles the zebra mussel (MacNeill 1991). The zebra mussel has two muscles attached to a shelf-like plate (septum) near the beak of the shell, while the dark false mussel has only one

muscle attached to the septum (the other muscle is attached to a projection of the septum)(MacNeill 1991).

The larval form (veliger) of the zebra mussel may be the first life stage to colonize an area (Marsden 1991), but it may remain undetected because of its small size (40-70  $\mu\text{m}$  in length)(O'Neill and MacNeill 1991). As post-veligers and adults, however, zebra mussels are more noticeable. They tend to aggregate on darkened surfaces and are more obvious on smooth substrates, especially PVC pipe (Marsden 1991; O'Neill and MacNeill 1991; Kilgour and Mackie 1993).

### Ecology

Zebra mussels generally inhabit shallow (2-7 m) waters of large (30 hectares or more) lakes and reservoirs but have been found at depths to 55 m (Marsden 1991; O'Neill and MacNeill 1991; Strayer 1991). They also occur in streams and rivers, especially those wider than 30 m (Strayer 1991), and in zones where water currents are 0.15-0.5 m/s (O'Neill and MacNeill 1991). Zebra mussels prefer temperatures of 20-25 °C (O'Neill and MacNeill 1991), but females begin to release eggs at temperatures as low as 12 °C (Neumann et al. 1993). Growth is limited below 10 °C, and high mortality is likely above 32 °C (Strayer 1991). Zebra mussels can adapt to salinities of 2.5 ‰ and have been found in waters with salinities to 12 ‰ (O'Neill and MacNeill 1991). Transparent (2 m or more) water with a calcium hardness higher than 50 mg/L as  $\text{CaCO}_3$  appears to be preferred (Strayer 1991). However, zebra mussel populations have high genetic variability (Hebert et al. 1989) and probably can adapt to many environments.

Female zebra mussels become reproductive at about 10 mm in length, usually 1-2 years of age (Hebert et al. 1989), but occasionally they are sexually mature at about 3-5 mm in length (O'Neill and MacNeill 1991). They produce 6,000-1,000,000 eggs/year (30,000 is typical), depending on body size, and typically live for 3-6 years (Hebert et al. 1989; MacIsaac et al. 1991; Marsden 1991; O'Neill and MacNeill 1991; Ramcharan et al. 1992). Even though more than 99% of the veligers and subadults may die annually (MacIsaac et al. 1991), enough young adult zebra mussels can survive and can be found in densities of up to 800,000 mussels/ $\text{m}^2$  (Kovalak et al. 1993). Zebra mussel populations appear to stabilize in time, but large population fluctuations are known to occur in 3- to 4-year cycles during the invasive periods of establishment (MacNeill 1990c).

The life cycle is diagrammed in Figure 2. The free-swimming veliger of the zebra mussel is similar in size and feeding habits to herbivorous rotifers (MacIsaac et al. 1991) and may be planktonic food for some fishes. The post-veliger attaches to a substrate with byssal fibers (strong, elastic strands) within several days (Hebert et al. 1989). Attached zebra mussels filter large volumes of water (up to 2 L/d for a single 25-mm zebra mussel) to obtain food (O'Neill and MacNeill 1991). Dense populations of zebra mussels can remove up to 18% of a lake's production (Ramcharan et al. 1992) and may be able to filter the volume of the western basin of Lake Erie in a matter of days (Leach 1993). Adult zebra mussels can consume plankton, including zebra mussel veligers, up to 0.4 mm long (MacIsaac et al. 1991).

## Potential Impacts

Zebra mussels can affect the aquatic ecosystem by altering food webs (Griffiths 1993), competing with native clams (Hebert et al. 1989; Schloesser and Kovalak 1991), increasing water clarity by removing plankton (Ramcharan et al. 1992), and increasing parasite levels, especially when the zebra mussel population levels are highly variable (MacNeill 1990b). Spawning beds of fishes may be adversely affected (Ramcharan et al. 1992), although zebra mussels seem to have little effect on walleye egg incubation in areas with moderate current (MacNeill 1990a; Leach 1993).

Water pipes and intakes can become so encrusted with zebra mussels that flow effectively is shut off. Up to 7,000 kg of zebra mussels/km have been found in some stretches of pipe in Ontario (Craves 1992). Drinking water can be fouled by decaying mussels in these dense aggregations (O'Neill and MacNeill 1991). The excretions from these mussels also can speed up corrosion of metals (O'Neill and MacNeill 1991).

Boats, marinas, piers, and almost any surface in contact with water can become covered with zebra mussels where they occur in high numbers. Zebra mussels have sunk floating docks and buoys (up to 14 kg/m<sup>2</sup> added weight), affected navigation, and littered the shoreline making strolls along the beach hazardous to the feet and offensive to the nose (O'Neill and MacNeill 1991). Monetary estimates for control, cleanup, repair, retrofitting intake structures, and losses to Great Lakes fisheries range from almost \$500 million to \$4.2 billion per year (Pitlo 1991; Craves 1992).

## Range

The range, as of March 1993, of the zebra mussel is shown in Figure 3. In time, much of southern Canada and the continental United States north of the Florida panhandle likely will be inhabited by zebra mussels (O'Neill and MacNeill 1991). Populations probably will not flourish in calcium-poor or very warm waters (Strayer 1991). Some of the waterways by which the zebra mussel may eventually work its way into Texas also are shown in Figure 3. Potential modes of dispersal include waterways, pipe systems, boat hulls, boat motors, live wells (or fish-hauling tanks), trotlines, gill nets, floating algae mats, waterfowl, flood events, fish-shipping boxes, and even the wind (for veligers). Adult zebra mussels can survive out of water for several days if the humidity is high (Griffiths et al. 1991; O'Neill and MacNeill 1991).

## Control

Some fishes such as carp and freshwater drum feed on zebra mussels in the Great Lakes (O'Neill and MacNeill 1991). Waterfowl, especially diving ducks, can prey heavily on the mussels (O'Neill and MacNeill 1991), but the density for effective control is estimated to be as high as 100,000 ducks/hectare (Craves 1992). In Europe, where the

zebra mussel has been a resident for about 200 years, the relatively small size and stability of some zebra mussel populations probably are at least partly due to waterfowl predation.

Mechanical control can help keep the zebra mussel from spreading. Measures include filtering intake pipes, using specially designed centrifugal pumps to kill veligers, scraping surfaces that have been in contact with infested waters, draining boat water, leaving bait behind, drying exposed surfaces in the sun, and heating exposed surfaces by flushing with hot (higher than 60°C) water or pressurized steam (O'Neill and MacNeill 1991). Where practical, ultraviolet B radiation, high frequency (20 kHz or higher) and high intensity sounds, electrically charged surfaces, and electrostatic filters (up to 600 V/cm for 0.1 s) also may help control the zebra mussel (Tuttle 1990; O'Neill and MacNeill 1991). Coatings (e.g., zinc galvanizing, tributyltin oxide), copper pipes, and high water flows can impair mussel attachment (O'Neill and MacNeill 1991).

Chemical control also may be considered. However, pesticides may have adverse environmental effects and pesticide use often requires a permit which must be obtained before using the materials.

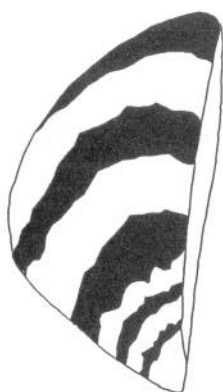
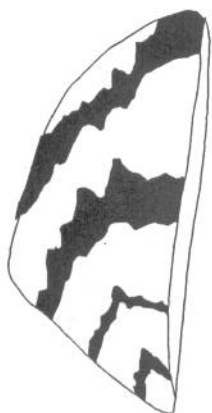
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Figure 1. Examples of banding variation in adult zebra mussels.



10 mm

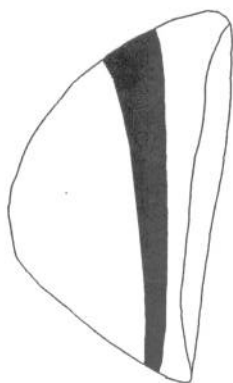
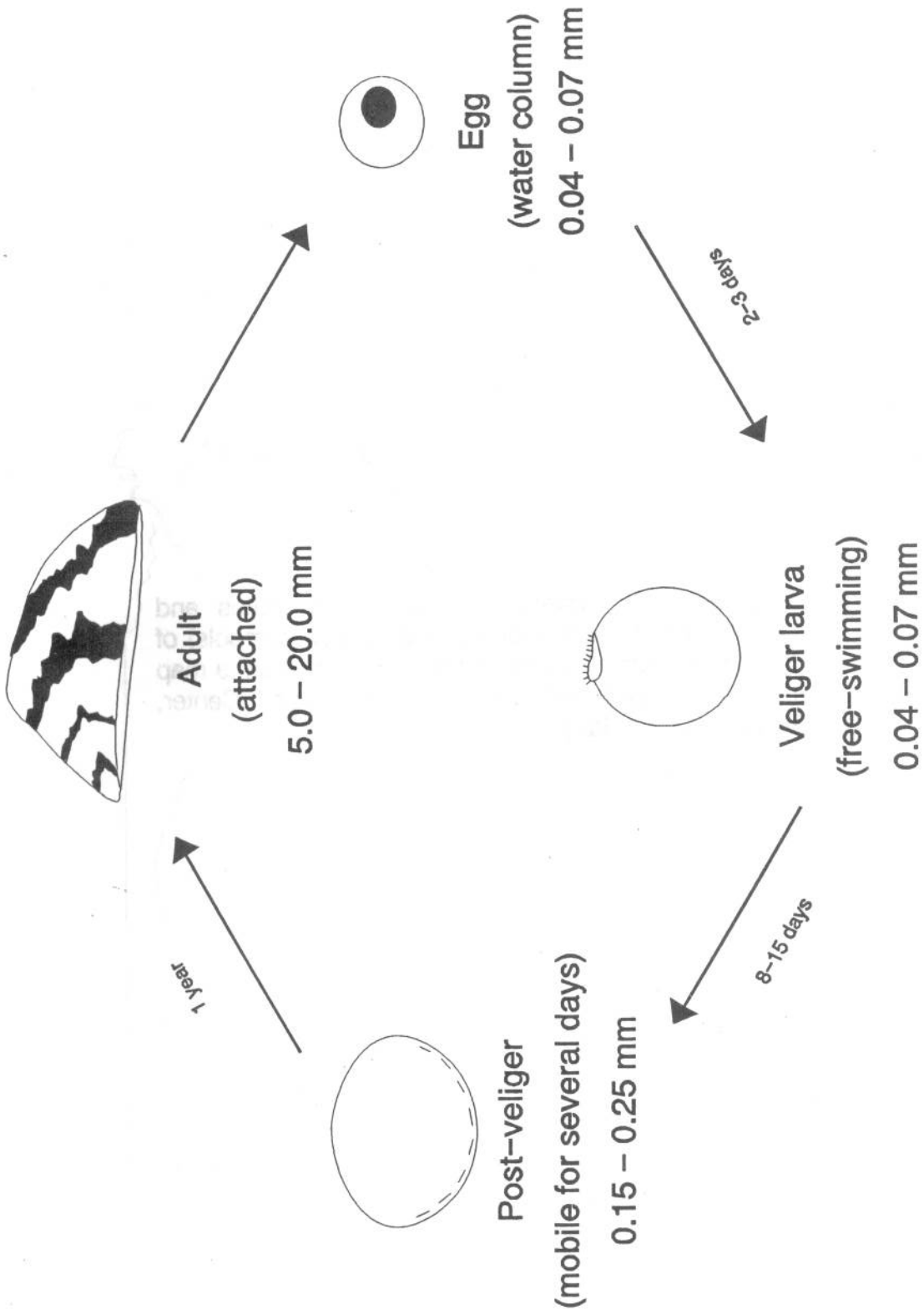


Figure 2. The life cycle of the zebra mussel.



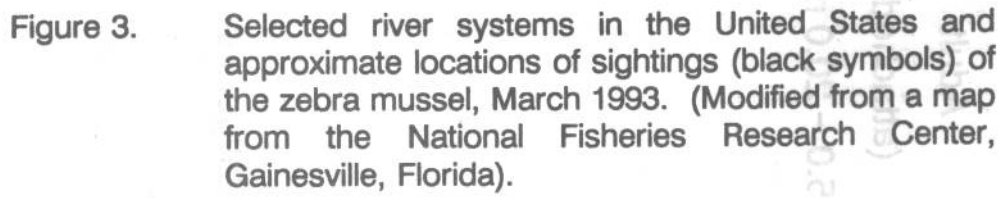
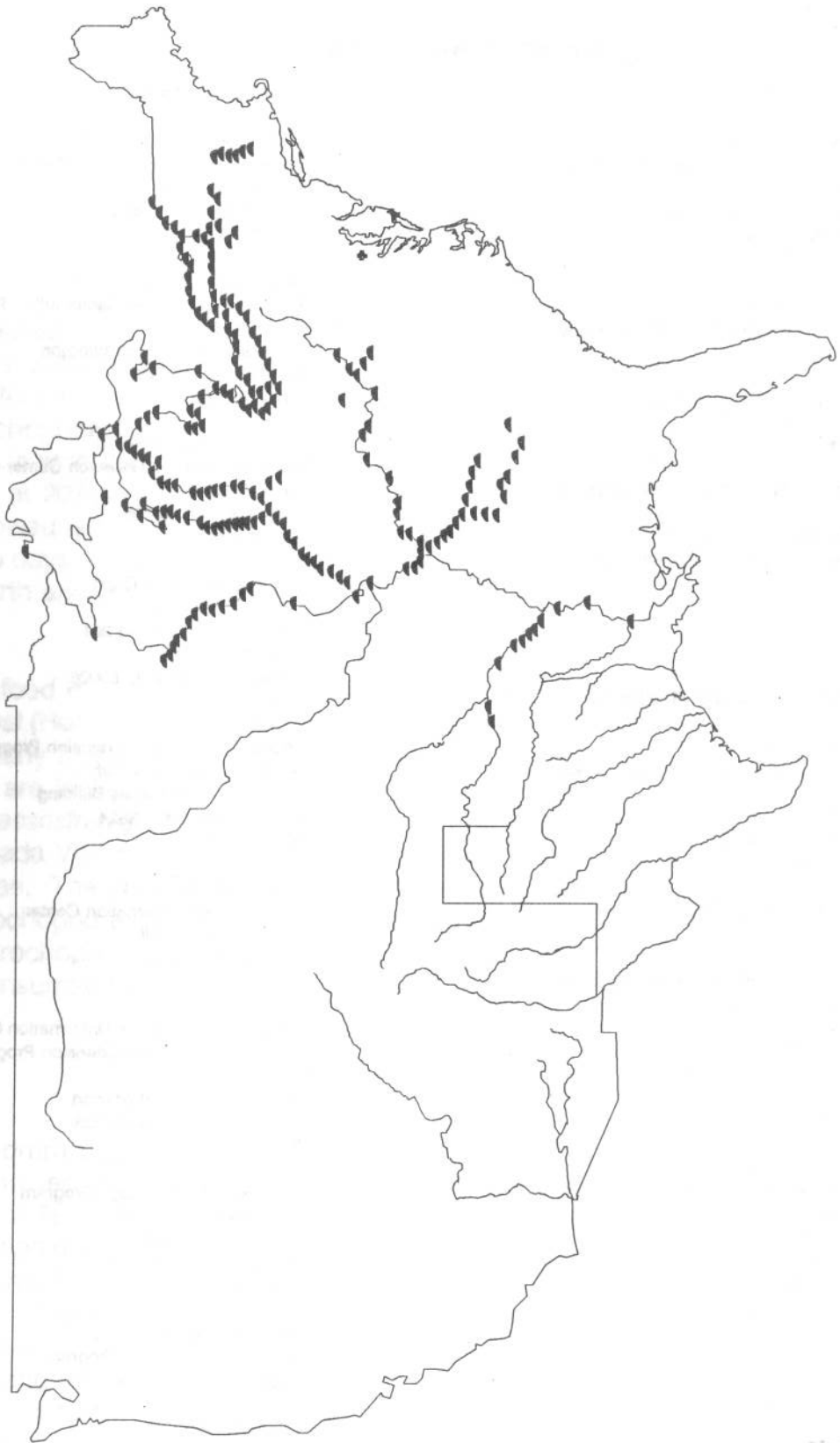


Figure 3. Selected river systems in the United States and approximate locations of sightings (black symbols) of the zebra mussel, March 1993. (Modified from a map from the National Fisheries Research Center, Gainesville, Florida).



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## Pacific Oyster (*Crassostrea gigas*) Trochophores as a First Food for Red Drum (*Sciaenops ocellatus*) Larvae

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**Abstract** - The trochophore-stage of commercially produced Pacific oyster (*Crassostrea gigas*) larvae was tested as a substitute for laboratory grown rotifers in the diet of red drum (*Sciaenops ocellatus*) larvae. Among four trochophore densities tested, 5/ml, 10/ml, 20/ml and 40/ml, larvae fed at the lowest level ate significantly fewer trochophores. The red drum larvae fed at 20/ml consumed the most trochophores. A prey preference study showed red drum larvae selected trochophores over rotifers during the first two days of feeding. No preferences were seen on the third day but on the fourth and fifth days of feeding rotifers were selected over trochophores.

Live food for first feeding is critical to larval red drum (*Sciaenops ocellatus*) growth and survival (Holt 1992). The quality and availability of cultured rotifers, the traditional first food of many marine larvae, are inconsistent (Watanabe et al. 1983) and culture and collection are highly labor-intensive. Commercially available trochophore-stage Pacific oyster (*Crassostrea gigas*) larvae (Trochofeed, MTL Biotech, Box 5760, Station B, Victoria, B.C., Canada V8R 6S8) were tested as a viable substitute for rotifers in the diet of red drum larvae. The viability of trochophores as a first food was evaluated in three ways: optimal trochophore feeding density for first feeding red drum larvae; larval prey selection between trochophores and rotifers; a comparison of the number of trochophores and rotifers consumed by the larvae.

### Materials and Methods

Red drum eggs were collected from broodstock spawned under a temperature-photoperiod regime (Arnold 1988) at the Fisheries and Mariculture Laboratory of the University of Texas Marine Science Institute. Rotifers were cultured in this laboratory on a combination of *Isochrysis* aff. *galbana* and *Chlorella minutissima*. Cryopreserved Pacific oyster trochophore-stage larvae were obtained from MTL Biotech Ltd. in Victoria, British Columbia. These commercially produced trochophores were thawed and shipped as approximately 15-hour-old ciliated larvae in which shell formation has not yet begun.

Foraging efficiency of larval red drum was tested at four prey densities, each set up in triplicate 1-L beakers containing 10 four-day-old larvae. Red drum larvae were offered one of four prey densities: 5, 10, 20 and 40 trochophores/ml. Larvae were allowed to

feed for 18 hours at 26 °C and 30 ppt salinity. Red drum larvae at this stage are transparent, therefore, trochophores can be identified and counted through the gut membranes using a dissecting microscope. To verify this technique, 12 larvae (three from each treatment) were preserved in formalin, the guts excised and the contents counted. The external viewing method was found to be 98% accurate.

For the prey selectivity test, six 150-L conical tanks, at 26 °C and 30 ppt salinity, with internal biological filters (Craig et al. 1990) were each stocked with 1,000 red drum eggs. The photoperiod was 12 h L: 12 h D. Rotifers were size-sorted to 45-100  $\mu\text{m}$  for the first three days of feeding and to 45-150  $\mu\text{m}$  for days 6-7. Beginning on the first day of feeding (day-3 posthatch) rotifers were added to duplicate tanks at 10/ml, trochophores added at 10/ml and a combination of 5 rotifers and 5 trochophores/ml added to the final tanks. On days 3-7, five larvae were taken from each tank in the afternoon after 4-5 h feeding and guts were dissected to determine content. The external viewing method was not used because rotifers, unlike trochophores, were not clearly visible through the gut. Larvae were measured on a Wild M8 stereomicroscope, equipped with drawing tube, and a Summasketch digitizing pad and mouse-puck using Jandel Scientific SigmaScan 3.90 software. Notochord length of larvae was measured as the distance (mm) from the tip of the upper jaw to the end of the notochord. Resulting data were tested using one-way ANOVAS and Scheffe's tests with SAS Institute Inc. software.

## Results and Discussion

Day-4 larvae ate significantly fewer trochophores at the 5/ml density but there was no significant difference between the 20 and 40/ml densities or between the 10 and 40/ml densities ( $n=12$ ,  $F=111.53$ ,  $P > 0.001$ )(Fig. 1). The larvae consumed the most trochophores at the 20/ml prey density. Optimal trochophore feeding density for red drum larvae maximizes the number of trochophores ingested and minimizes waste. Therefore, the prey concentration most effective for first feeding red drum larvae would be between 10 and 20 trochophores/ml.

During the week-long prey selectivity study, larvae ingested more trochophores than rotifers the first two days of feeding but ate more rotifers the last two days (Table 1). This was especially clear when larvae were offered a choice of either rotifers or trochophores in the combination treatment (Fig. 2). Trochophores were clearly preferred the first two days, there was no selectivity shown on day 5, but on days 6 and 7 rotifers were significantly preferred ( $n=50$ ,  $F=4.69$ ,  $P < 0.01$ ). Size selectivity may explain this preference change, although prey detection (*i.e.*, color, contrast, mobility) and capture are also important in food selection of larval sciaenids (Govoni et al. 1986). Trochophore diameter is 50-65  $\mu\text{m}$  whereas rotifers ranged up to 100  $\mu\text{m}$  in diameter during the first three days of feeding (days 3-5) and up to 150  $\mu\text{m}$  the last two days (days 6-7) of the study.

Throughout the study, larvae ate significantly more organisms ( $n=145$ ,  $F=11.24$ ,  $P < 0.01$ ) when offered a choice than when only one type of prey item was present (Fig. 3). An increase in growth rate was observed on days 4 and 5 in larvae fed only

trochophores (Table 2), however lengths at day 7 showed no significant differences among treatments.

Red drum larvae can be weaned to artificial diets on day 8 after feeding on live rotifers for only five days (Holt, in press). The availability of ready-to-use trochophores could alleviate the necessity for labor intensive, costly production of rotifers. Additional growth and survival studies on trochophore-fed marine fish larvae, whether alone or in combination with artificial diets, are needed to determine their value in replacing rotifers as a first food.

### Acknowledgements

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Table 1. The mean (and SE) number of organisms counted daily in the guts of larval red drum fed rotifers (R) or trochophores (T) or a combination of rotifers and trochophores.

	R	T	Combination	
			R	T
Day 3	4.8 (0.49)	7.5 (1.10)	2.1 (0.50)	5.2 (0.55)
Day 4	5.3 (0.60)	6.5 (1.02)	3.1 (0.50)	5.5 (0.75)
Day 5	2.5 (0.52)	3.3 (0.45)	1.9 (0.35)	3.3 (0.97)
Day 6	3.9 (0.53)	2.5 (0.54)	3.9 (0.31)	2.0 (0.26)
Day 7	5.2 (0.66)	3.0 (0.45)	4.1 (0.46)	1.9 (0.64)

Table 2. Daily growth rate of red drum larvae fed rotifers (R), trochophores (T), or a combination of the two (RT). Numbers are mean (and SE) change in notochord length (mm/d). A significant difference at the 0.01 level is denoted by \*.

	AGE (days)			
	4	5	6	7
R	0.08 (0.011)	0.06 (0.004)	0.05 (0.000)	0.13 (0.016)
T	0.11 (0.001)	0.08 (0.000)*	0.05 (0.000)	0.10 (0.015)
RT	0.05 (0.000)*	0.05 (0.004)	0.05 (0.000)	0.14 (0.016)



**Figure 1.** Mean number of trochophores in the guts of day-4 larval red drum fed at various trochophore densities. Bars are standard errors and means with the same letter are not significantly different.

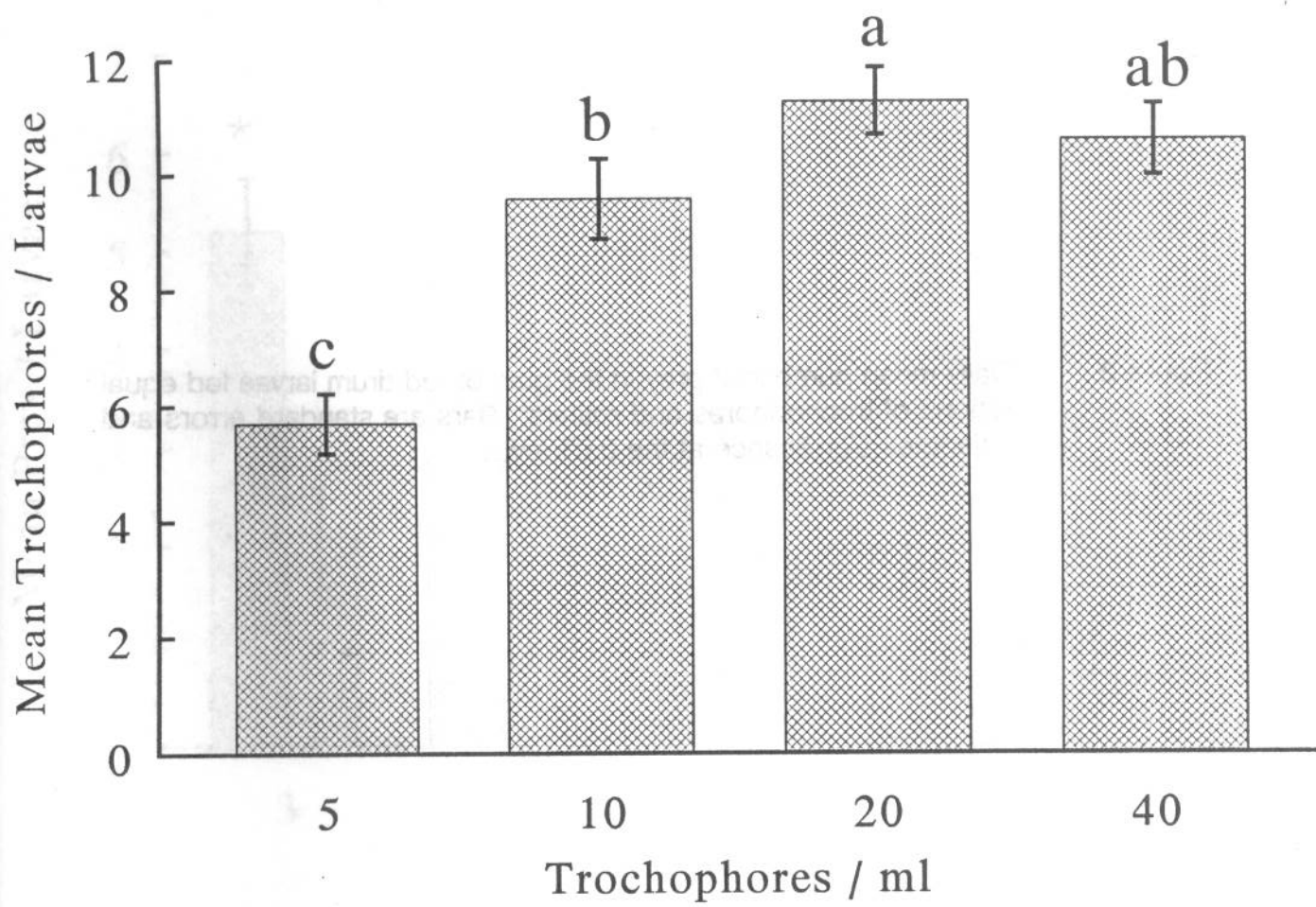
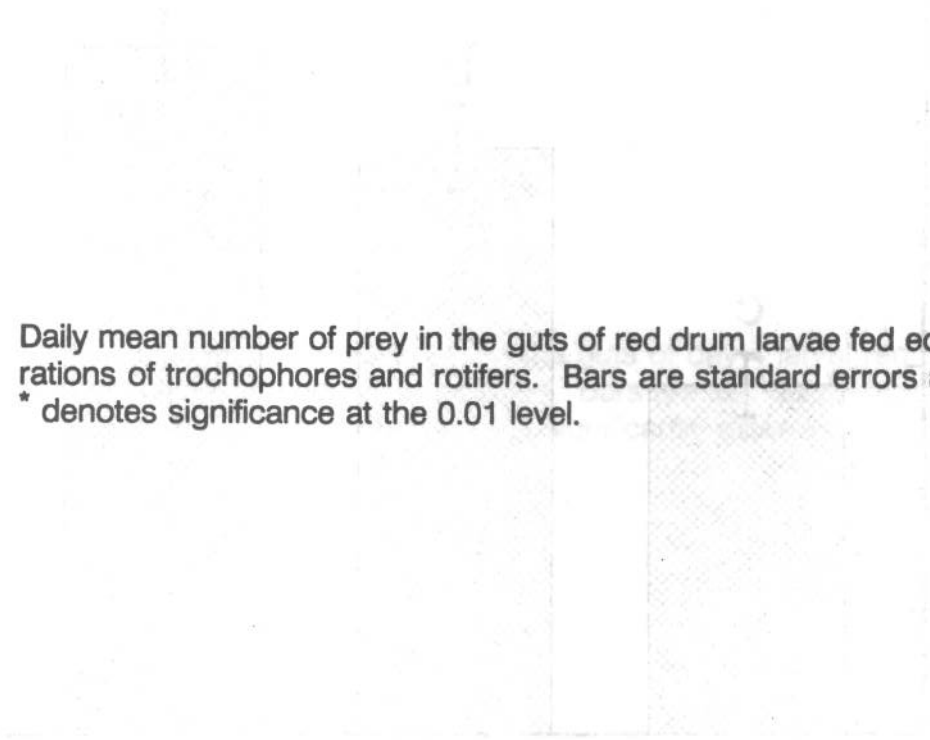


Figure 2. Daily mean number of prey in the guts of red drum larvae fed equal rations of trochophores and rotifers. Bars are standard errors and \* denotes significance at the 0.01 level.



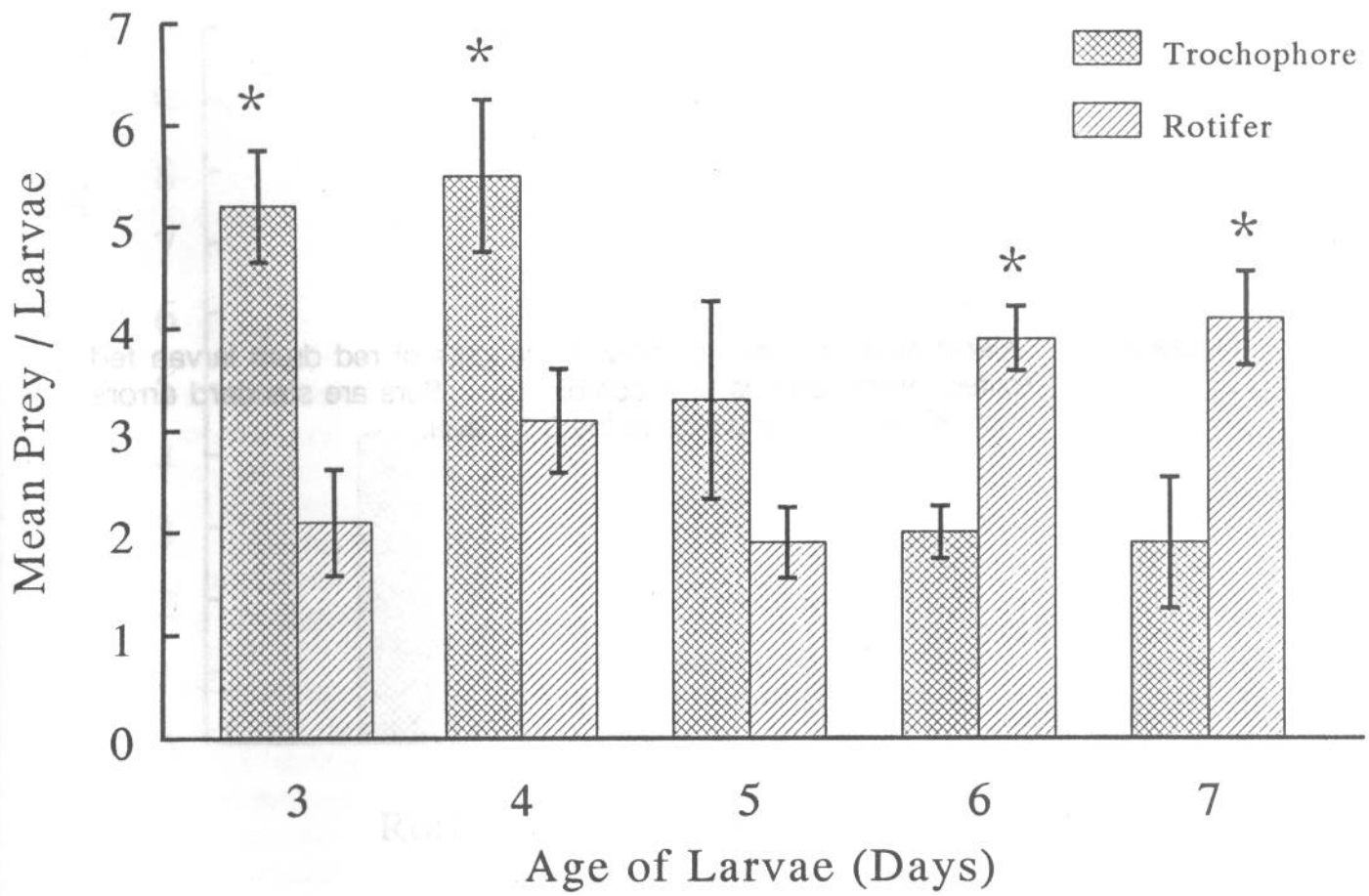
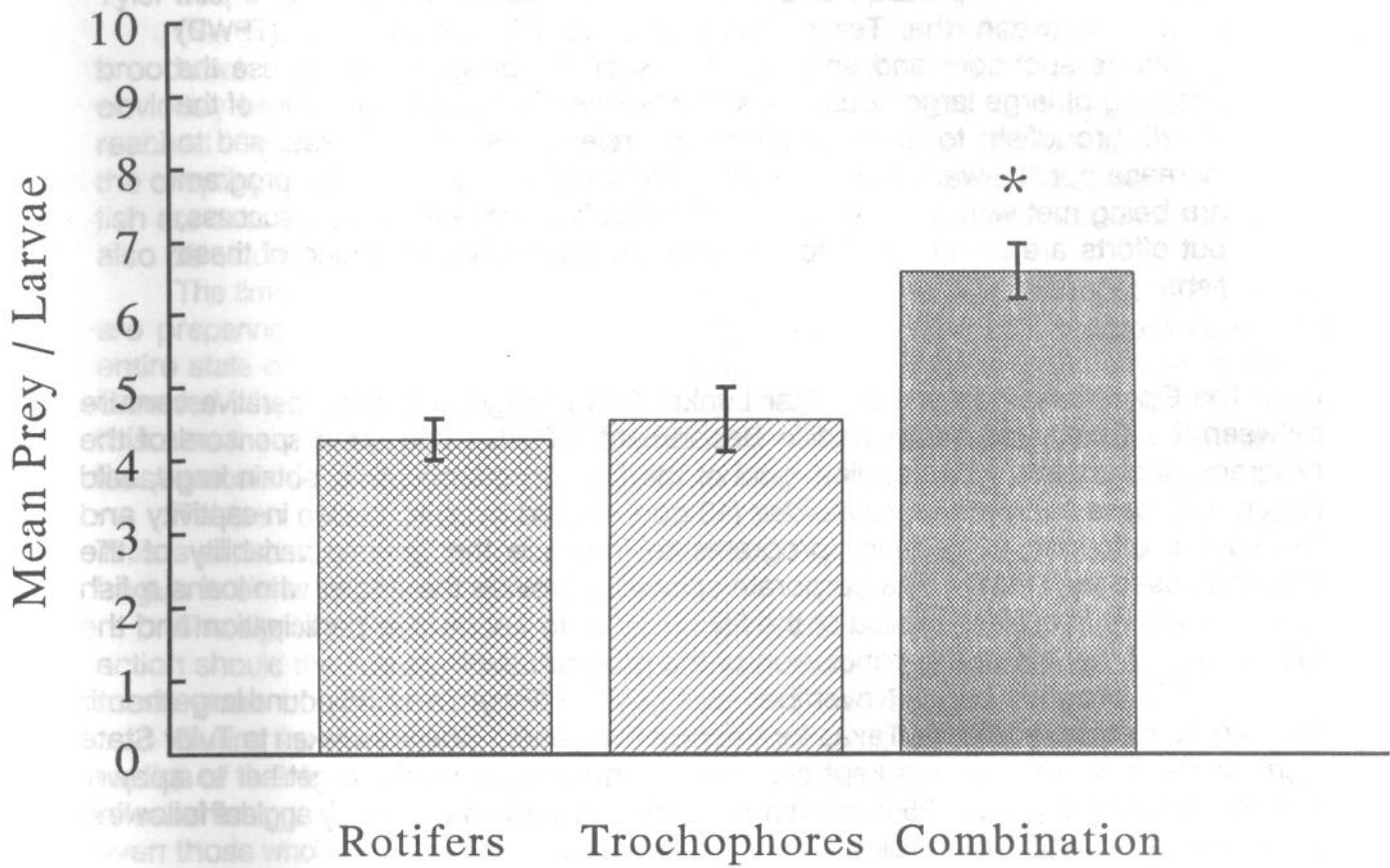


Figure 3. Overall mean number of prey in the guts of red drum larvae fed rotifers, trochophores or a combination. Bars are standard errors and \* denotes significance at the 0.01 level.



## OPERATION SHARE A LONE STAR LUNKER PROGRAM AN OVERVIEW

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**Abstract** - The Operation Share a Lone Star Lunker program is a joint venture between the Texas Parks and Wildlife Department (TPWD) corporate sponsors and anglers. Goals of the program are to use the offspring of large largemouth bass to increase the genetic variability of the TPWD broodfish, to promote catch and release fishing in Texas, and to increase public awareness of TPWD. The latter two goals of this program are being met with great success. The first has met with limited success, but efforts are being made to increase the productive spawning of these fish.

The Operation Share a Lone Star Lunker (LSL) program is a cooperative venture between the Texas Parks and Wildlife Department (TPWD), corporate sponsors of the program, and anglers. The original goal of the LSL program was to obtain large, wild largemouth bass *Micropterus salmoides* (13 pounds and over) to spawn in captivity and to use the offspring in genetics programs to increase the genetic variability of the broodfish used by TPWD. The corporate sponsors provide the angler who loans a fish to TPWD with a fiberglass replica of the fish in order to encourage participation and the live release of the fish at the conclusion of the program each year.

The LSL program began November 26, 1987 with "Ethyl", a 17.65 pound largemouth bass and the state record for Texas for the next five years. She was taken to Tyler State Fish Hatchery where she was kept alive and attempts were made to get her to spawn. During subsequent years, 125 more fish were entered in the program by anglers following a set of simple participation rules.

### PROCEDURES

The current rules of the LSL program are as follows:

1. The fish must be legally caught in the state of Texas. It may be caught in either public or private waters.
2. The fish must be caught between December 1 and April 30 and be in good condition to be acceptable.
3. The fish must weight 13 pounds or more.

4. The angler must sign a release stating that he understands the terms of the program, and that he will not hold TPWD and its sponsors responsible if the fish should die while in their custody.
5. The corporate sponsor will provide the angler with a free fiberglass replica of his fish.

These simple guidelines make the angler aware of the importance of delivering the fish in good condition to a marina or other location where it can be safely held. In most locations the marina owner is willing to place the fish in a minnow tank. If a minnow tank is not available, a horse trough or a similar tank can be used. The angler then contacts Tyler State Fish Hatchery and a truck is sent to pick up the fish immediately.

One goal of the LSL program is to increase the genetic variability of hatchery-reared broodstock used by TPWD by using fish caught in the wild. These large fish have obviously been able to take advantage of their environment, or they would not have reached 13 pounds. If the fish spawns while in the custody of TPWD it is more likely that the offspring will spawn in the wild. A final and important factor to the angler is that these fish are catchable and the offspring which will be in stocked reservoirs statewide should also be catchable.

The time span from December 1 to April 30 is the time in which most of the big fish are preparing to spawn or will have recently spawned. The LSL program covers the entire state of Texas with largemouth bass spawning during early December in the Rio Grande Valley of far south Texas and during late April in the panhandle of north Texas. It is also the time period during which the lake water is at its coolest, which places the least amount of stress on the fish during transport from lake to hatchery.

Thirteen pounds was chosen as the minimum weight for entry into the program. This is an arbitrary weight chosen as a cutoff by TPWD personnel when the program was begun in order to define the term "lunker".

The signing of a release by the angler protects TPWD and the sponsors from legal action should the fish die while in their custody. It also insures that the angler has been made aware of all of the rules pertaining to the LSL program.

During the summer the LSL corporate sponsor supplies each angler with a fiberglass replica of their fish. The replica is supplied to the angler in order to encourage catch and release fishing. The receipt of the replica has been a major draw for many of the anglers, even those who would have no interest in conservation of the resource are willing to loan the fish in exchange for the replica.

Once the fish has been transported to the hatchery by TPWD personnel, it is inspected thoroughly and given a salt bath. During the inspection the fish is measured in length and girth. Three scales removed from the fish's side are used to help in determining the age of the fish. A small tissue sample is taken from its tail and is compared to known standards, using electrophoresis, to determine if the fish is a pure *M. s. salmoides* or an intergrade with Florida largemouth bass *M. s. floridanus*. It is tagged (PIT) for later identification if it is ever caught again. The fins, tail, mouth, eyes, and general condition are evaluated by TPWD personnel and recorded. It is then placed in a holding tank for observation and later spawning.

TPWD personnel observe the fish daily and encourage it to feed by offering small feeder fish. If it is indicated, the fish may receive an injection of human chorionic gonadotropin (HCG) to attempt to induce spawning.

## RESULTS

The LSL program has grown in size and popularity each year that it has been in existence. It began with seven entries the first year and in the 1991-1992 season there were 33 entries. The majority of the fish entered in the program come from Lake Fork, with the program expanding to other reservoirs each year as more fish were caught. A total of 24 reservoirs have had fish entered in the LSL program. This ranged from three reservoirs having fish donated in 1989 to 11 different ones in 1990. Anglers from five states have participated in the program. When looking at the TPWD list of "Texas Top 50 Largemouth Bass", all but five of the fish that qualified for the LSL program participated. Looking at the TPWD list of "Texas Top 50 Largemouth Bass Excluding Lake Fork", all but seven of the qualifying fish were entered in the program. These results clearly illustrate the angler support for the program.

Anglers and marina owners are becoming more aware of the importance of proper handling of these big largemouth bass in order for them to be eligible for the LSL program or released back into their lake in good condition. For the most part, anglers are remembering to handle the fish with wet hands, to support the weight of the fish when it is out of the water, and to keep it in well aerated tanks which are large enough and deep enough for it to swim and remain completely submersed.

Spawning of the big largemouth bass has met with limited success. At least one fish entered in the program has spawned every year, but the technology to induce them to spawn consistently has not been developed. The highest mortalities occurred during the year (1988-89) that stressful methods were used to induce spawning in the big largemouth bass. Injections of different hormones were used to encourage spawning. The hormones used were LH-RH (luteinizing hormone-releasing hormone) and HCG. In all but two of the instances that the LH-RH was used the fish died, none of the fish receiving HCG died.

During the past two seasons (1990-91 and 1991-92), emphasis has been placed on the proper care and handling of the fish while in our care as opposed to inducing the fish to spawn. The fish is handled as little as possible and only while in the water. If the swimbladder is over-inflated upon arrival at the hatchery, the pressure is relieved immediately. When possible, approved chemicals are used to treat stress related infections. During the 1991-92 season, only six fish died while in the hatchery's care, of these, two of the fish were in poor condition when received into the program.

The increased emphasis on care of fish as opposed to attempting to induce spawning is the result of TPWD personnel's anticipation that a soon-to-be-built new facility will allow for greater control of the fish's environment, photoperiod and temperature, thus resulting in greater success in spawning the fish with a minimum of stress being placed on the "lunker".

The catch and release portion of this program has met with great success. All of the fish which were alive at the end of the program have been released back to the angler. These fish were either released into the waters from which they came, or they were placed on exhibit in an aquarium. None of the fish which were entered in the program were killed for a skin mount. Three fish have been re-caught, reported to TPWD, and released again. One of the fish has been entered in the program twice.

The LSL program has grown each year that it has been in existence. As more anglers become aware of the LSL program, more of them are fishing for the "lunker" largemouth bass with the goal of donating the fish to the program rather than mounting it. Of the qualifying largemouth bass reported caught during the 1991-1992 season, all but two were donated to the LSL program.

The LSL program has resulted in a great deal of positive publicity for catch and release of largemouth bass and for the Texas Parks and Wildlife Department. With the success of the LSL program more largemouth bass are being released in good condition during tournaments and by anglers fishing for fun. The TPWD has gained a great deal of good publicity for its work with this program, and its support of largemouth bass fishing in Texas. This program has come to be recognized across the country as an example of a positive relationship between the angler and the fisheries management authority.

### **FUTURE OF THE LSL PROGRAM**

As the LSL program continues to gain momentum among anglers, TPWD has determined the importance of developing a hatchery designed to maintain and care for these "lunker bass" during the time that they are in the program. Construction of this new facility is scheduled to begin in late 1993. Holding tanks which can be individually regulated to induce the spawning cycle should allow for greater success in spawning the "lunker bass", and it will continue to increase the success of TPWD in keeping them in good condition for release by the angler.

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