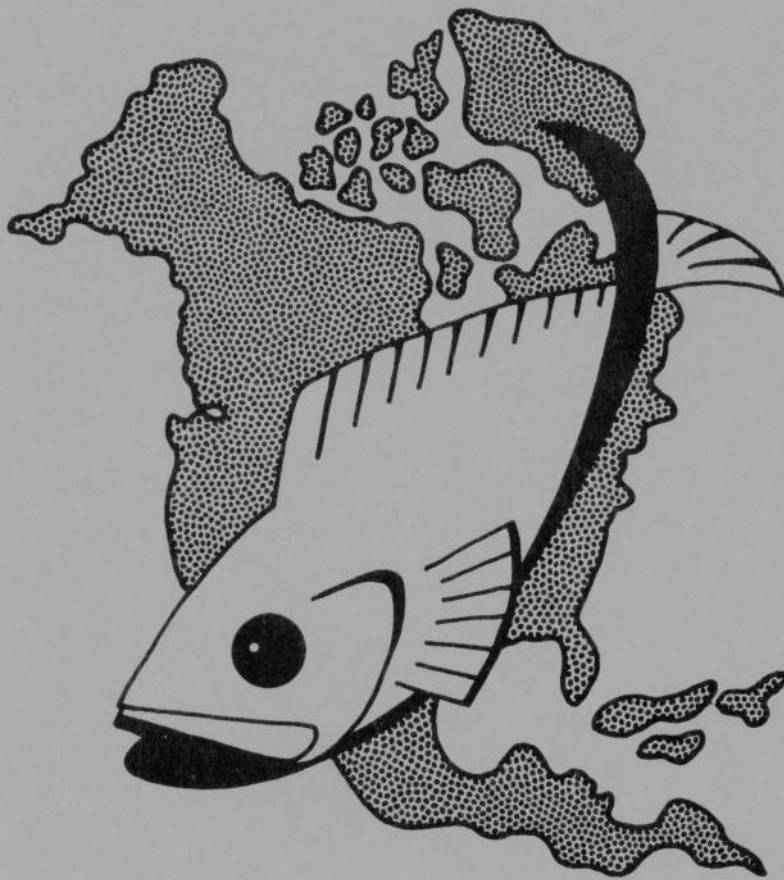


ANNUAL PROCEEDINGS
of the
TEXAS CHAPTER
AMERICAN FISHERIES SOCIETY



SAN ANTONIO, TEXAS
OCTOBER 5-6, 1989

VOLUME 12

TEXAS CHAPTER
OF THE
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 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 by 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 the Secretary-Treasurer, Barbara Gregg, Texas Parks & 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

October 5 and 6, 1989

San Antonio, Texas

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1990

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1989 TEXAS CHAPTER AWARDS

Outstanding Fisheries Worker of the Year

The recipient in the Management category was Joseph Kraai. Joe works for the Texas Parks and Wildlife Department at the Canyon District Office. Joe is recognized for development of trout fisheries in Panhandle reservoirs and research in radiotelemetry, yellow perch management, catfish management and the effects of water level fluctuations on West Texas fisheries.

The recipient in the Culture category was Robert Vega. Robert works for the Texas Parks and Wildlife Department at the Gulf Coast Conservation Association Marine Development Center in Flour Bluff. Under Robert's leadership, the development center has dramatically improved its broodfish condition, egg production and hatching rates. Consequently, a new record high number of red drum fingerlings were produced and stocked in 1989.

The recipients in the Research category were Roy Kleinsasser and Gordon Linam. Both work for the Texas Parks and Wildlife Department, Resource Protection Division at San Marcos. They are recognized for their work in modifying Karr's index of biotic integrity for application in evaluating fish communities within Texas ecoregions. Their modifications will be useful in assessing stream fish community status and environmental impacts, and identifying necessary protection activities for Texas streams.

Honorable Mention in the Research category went to Dr. Robert Edwards. Dr. Edwards is a professor at Pan American University in Edinburg and is recognized for his research in community dynamics of estuarine and freshwater fishes and for recovery efforts concerning several endangered fishes (eg., as leader of the San Marcos Recovery Team). He has presented the results of his activities to a variety of organizations, including the Texas Chapter.

The recipient in the Administration category was Dr. Gary Matlock. Dr. Matlock is the Fisheries Division Director for the Texas Parks and Wildlife Department in Austin. Some of the many achievements under his direction include the establishment of the Lone Star Lunker Program, increased protection of sport fishing through length limit management, addition of problem fish to the harmful fish list, establishment of paddlefish, striped bass, snook, tarpon and Guadalupe bass restoration programs, increased hatchery production, development of management plans for shrimp and oysters, development of genetic marking programs to evaluate stocking success and restoration and expansion of the A. E. Wood State Fish Hatchery.

Outstanding Presentation

The outstanding presentation was by R. Clay Smith of a paper entitled, "Behavior of Introduced Red Drum and Habitat-Use Overlap with Largemouth Bass in a Power-Plant Cooling Reservoir" which he coauthored with Brian R. Murphy as a graduate student at Texas A&M University.

REGULATION ISSUES: MOTHERHOOD, APPLE PIE AND
OPTIMUM SUSTAINED YIELD

by

Richard O. Anderson
National Fish Hatchery and Technology Center
Route 1, Box 159-D
San Marcos, Texas 78666

Abstract

The purpose of this presentation is to discuss some of the theory, issues and philosophies related to the regulation of recreational fisheries. My comments emphasize inland fisheries and management of black bass Micropterus spp.

Traditional logic behind restrictive size limits is related to reproduction (motherhood), simplicity (uniform, statewide regulations), and maximum sustained yield. This logic has proven to be irrational or ineffective in the formulation of management policies and programs.

Current logic and theory in support of conservative size limits include manipulation of population structure and dynamics to solve problems such as overharvest, achievement of measurable management objectives, improvement in the quality and quantity of fishing (apple pie and memories), and progress toward the idealistic goal of optimum sustained yield based on biological, political and economic considerations. Selected examples of progress and challenges will be discussed.

THE USE OF REGULATIONS IN FISHERIES MANAGEMENT

by

Hal Osborn
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744

Abstract

Fishing regulations are some of the most important tools available to fishery managers. They can be used to restrict access to fisheries, recover economic rent, increase economic value of fisheries, allocate resources among various users, prevent depletion of aquatic resources, maintain or modify population, age size or sex composition, reduce incidental fishing mortality and reduce water hazards. For regulations to be effective they must be understandable, generally supported by society, relatively easy to comply with, and enforced.

The application of fishing regulations in Texas is primarily the responsibility of the Legislature. However, the Legislature has delegated much of its authority to the Texas Parks and Wildlife Commission. Although many activities are involved, my comments will focus on regulating what can be taken and when, where, and how it can be taken.

The approach generally taken to restrict harvest is to prohibit all activity except that specifically authorized. This precludes the need for a list of prohibited gear or the need for adopting rules that would prohibit a "new", undesirable gear from being used.

Regulations are generally applied statewide with limited exceptions applicable in selected areas. While some precision may be lost in some locations from not tailoring each regulation for each species in each water body, the benefits or increasing understanding, enforcing compliance, and reducing administrative costs far exceed the possible lost precision.

The Texas Parks and Wildlife Department has only recently begun to implement this philosophy of fisheries management for all species throughout Texas. Since 1983, many changes have been imposed in both fresh and saltwater fisheries. For example, game fishes may be taken on pole and line only, gill and trammel nets and seines are no longer allowed for taking fish in salt water, size, bag, and possession limits are now in place for over 30 fishes, above-water trotlines are no longer allowed, and possession of stone crabs is prohibited. These regulations have already been successful in improving fishing. The future is bright for the continued use of regulations to meet the increasing demands for quality fishing in Texas.

THE GULF COAST CONSERVATION ASSOCIATION'S ROLE
IN FISHING REGULATIONS

by

Ray Poage
Gulf Coast Conservation Association
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Houston, Texas 77056

Abstract

The Gulf Coast Conservation Association (GCCA) was first founded in 1977; that year nearly 1,500 Texans joined the organization to fund projects to prevent declines in fish populations. By March, 1978 a political arm was formed to work for favorable legislation.

One of the biggest early accomplishments was the planning and finally the completion of John Wilson Hatchery in Flour Bluff, the largest red drum Sciaenops ocellatus hatchery in the world.

In the spring of 1983, significant legislation supported by GCCA was passed including legislation giving the Texas Parks and Wildlife Department authority to set limits on fish and prohibiting commercial harvest of red drum and spotted seatrout Cynoscion nebulosus. By the summer of 1985, GCCA had donated about \$400,000 to marine research activities in Texas and Alabama, as well as an additional \$200,000 for improved law enforcement equipment in Texas. That same year more significant legislation such as the Salt Water Stamp Bill passed after being vigorously supported by GCCA.

In January, 1986 an additional \$2,000,000 was given for expansion on the GCCA/Central Power and Light (CPL) Marine Development Center. Later that year legislation was passed which effectively closed the Gulf red drum fishery for 1987. The following year work began on a \$4.5 million expansion of the GCCA/CPL Marine Development Center.

Probably one of the biggest landmarks in GCCA-supported actions came in July, 1988 when the Texas Parks and Wildlife Commission voted to remove all nets from Texas coastal waters, a move hailed as one of the biggest victories for conservation since the Redfish Bill of 1981.

GCCA will continue to support research, management and legislation aimed at enhancement of sport fishing opportunities and conservation of natural resources.

TEXAS BLACK BASS UNLIMITED HISTORY AND
ACCOMPLISHMENTS 1985 TO 1988

by

Joe T. Rogers
P. O. Box 631856
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Abstract

Texas Black Bass Unlimited (TBBU) was first founded in 1985, when nineteen concerned sportsmen met to discuss the need to form an organization which would represent Texas freshwater anglers in Austin. By the end of that year the organization had 200 dues paying members. By January, 1986 the organizations Constitution and Bylaws were approved and a political action committee was created. Major actions by TBBU in 1986 included objection to the Texas Parks and Wildlife Department's (TPWD) continued stocking of exotic fishes and opposition to the TPWD's proposed 5-fish daily bag and 14-inch minimum length limits on black bass.

In 1987, TBBU released the results of a survey conducted at boat shows throughout 1986. They showed the most popular species of freshwater game fish were largemouth bass Micropterus salmoides, crappie Pomoxis spp., catfish Ictalurus spp., striped bass Morone saxatilis, smallmouth bass Micropterus dolomieu, sunfish Lepomis spp. and hybrid striped bass M. chrysops x M. saxatilis. That same year TBBU requested that two species of tilapia Tilapia spp. be returned to the potentially harmful fish or fish egg importation list. We also purchased a computer system for the Tyler Fish Hatchery. The political action committee has monitored approximately 40 house and senate bills which would effect directly or indirectly our inland fisheries.

In addition to the items listed, TBBU has been involved in numerous projects such as nursery pond construction, aquatic vegetation planting, and habitat construction. All of this has been accomplished with volunteer labor.

The present goal is to achieve a statewide membership of 10,000 anglers interested in the future of Texas inland fisheries.

FISHING REGULATIONS FROM AN OUTDOOR WRITER'S PERSPECTIVE

by

Dan Klepper
San Antonio Express-News
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San Antonio, Texas 78200

Abstract

In my remarks, I would like to address two aspects of fishing regulations. The first aspect concerns adjusting bag and size limits on fish in each individual body of water to produce a healthy, productive fishery. The second aspect concerns changing of regulations without informing the public and giving anglers an opportunity to comment.

Reservoir-specific regulations are the most realistic. Although uniform regulations on a large number of dissimilar reservoirs might not result in serious damage to fish populations, no two fish populations, either on different reservoirs or the same reservoir at different times, are the same. Size and bag limits should be changed as often as necessary to maintain a viable fishery. Even though tailored regulations may be slightly confusing to the public, they will not be as difficult as duck hunting regulations. At least anglers have the opportunity to practice catch-and-release.

A bitter disappointment was the decision by the Texas Parks and Wildlife Department to remove bag and size limits on orangemouth corvina Cynoscion xanthulus and their hybrids (with spotted seatrout C. nebulosus) on Braunig and Calaveras reservoirs near San Antonio. The method used to change the regulations was underhanded; anglers were not openly informed such a decision was being contemplated and, therefore, given no opportunity to comment. I found it incredible that any state agency would kill a successful fishery without informing the public and giving the anglers a chance to be heard.

LAW ENFORCEMENT'S ROLE IN TEXAS FISHERY MANAGEMENT

by

Jim Robertson
Texas Parks and Wildlife Department
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Austin, Texas 77844

Abstract

The first known management of Texas' fishery resources occurred in 1874 with the passage of the first law to protect fish. That law placed restrictions on coastal netting and seining with enforcement left up to existing enforcement agencies. In 1879, the Texas Fish Commission was established to enforce laws and stock several species of fish in Texas.

Law enforcement over the years has taken the role of managing people while fishery biologists study and manage the resource. The two acting together is the only effective way to protect, conserve, and insure future generations the use of Texas' fishery resources.

With regulations in place, the public must comply for the resource to prosper and provide maximum benefit. History has taught us that voluntary compliance is practiced only by a relatively small percentage of anglers. Law enforcement is charged with the responsibility of gaining compliance from the majority. The Law Enforcement Division of the Texas Parks and Wildlife Department accomplishes the goal of insuring compliance with regulations through 1) education, 2) prevention and 3) apprehension. Using these ways of altering human behavior, law enforcement manages people to implement fishery management strategies and to protect the resource.

A coordinated effort between fishery biologists and law enforcement is the key to effective fishery management. Fishery biologists must formulate enforceable regulations needed to maintain the resource, and law enforcement must manage the users of the resource to insure compliance with regulations.

THE USE OF REGULATIONS IN FISHERIES MANAGEMENT -
PANEL DISCUSSION

Participants: Dick Anderson, United States Fish and Wildlife Service
Hal Osborn, Texas Parks and Wildlife Department, Fisheries Division
Ray Poage, Gulf Coast Conservation Association
Joe Rogers, Texas Black Bass Unlimited
Dan Klepper, San Antonio Express-News
Jim Robertson, Texas Parks and Wildlife Department, Law Enforcement Division

QUESTION: ARE YOU AWARE OF ANY ADVERSE IMPACTS TO LARGEMOUTH BASS IN OTHER STATES DUE TO STOCKING OF GRASS CARP OR ARE GRASS CARP, IN YOUR OPINION, A SAFE BIOLOGICAL CONTROL OF AQUATIC VEGETATION, SPECIFICALLY HYDRILLA?

ANSWER: (ANDERSON) I cannot think of any. Grass carp, triploid or diploid, are being stocked in a number of states. Many states have liberalized their regulations on triploid grass carp. I think many states do suffer from a problem of excessive density of submerged aquatic plants, particularly hydrilla, and especially in terms of multiple use of those waters. I think Alabama has documented repeatedly in the management of their impoundments that they don't like to see any vegetation at all; these waters retain good productivity for a fish community.

Q: ISN'T IT TRUE THAT T.B.B.U. ACTIVELY OPPOSES MANY OF TEXAS PARKS AND WILDLIFE DEPARTMENT'S REGULATIONS BECAUSE THEY FEEL THESE REGULATIONS REDUCE PARTICIPATION IN BASS TOURNAMENTS, EVEN THOUGH THESE REGULATIONS ARE IN THE BEST INTEREST OF THE RESPECTIVE FISHERIES? PLEASE DISCUSS YOUR PRESENT POSITION.

A: (ROGERS) No, I don't feel this is the case. T.B.B.U. not only represents bass tournament fishermen and bass tournaments in Texas, but also crappie fishermen, catfish fishermen and anyone else. Let's take a look at bass tournament fishing as such. A lot of people will complain that bass tournaments have ruined bass fishing in Texas. Most bass clubs have had tournaments with restrictive size limits long before Texas Parks and Wildlife Department changed their size limits. They went to live release programs long before catch-and-release was popular in Texas. Very few bass caught in bass club tournaments are taken home and eaten. Practically every club in Texas that I know of has voted in their bylaws to release their fish alive. T.B.B.U. is not a bass tournament fishing organization. We have one tournament a year and that's in conjunction with our annual banquet. Last year that tournament was held at Choke Canyon Reservoir and of all the fish weighed in we only had one dead fish. So I don't think we oppose Texas Parks and Wildlife Department regulations

just to enhance bass tournament fishing. Right now there's not that much interest in any Texas Parks and Wildlife regulations that interfere with tournament fishing in Texas as far as I'm concerned.

Q: WHAT EDUCATION PROGRAMS WOULD BE NECESSARY TO LET TEXAS PARKS AND WILDLIFE DEPARTMENT USE MORE "TAILORED" LIMITS?

A: (OSBORN) I think the best answer would be an expansion of the current programs. Given the large influx of tourists throughout the state, you will always have a large segment of the fishing population that is not aware of special regulations despite intensive education efforts in the time period just prior to that. You also have the fact that many people in the lower income groups are not interested in taking the time to be educated. The education programs are not always able to target the people you want. So a preferable method is to make the regulations very simple and broad based enough to accomplish your management goals in a particular lake.

Q: CAN FISHERY MANAGERS DO ANYTHING TO MAKE IT EASIER TO ENFORCE FISHERIES REGULATIONS?

A: (ROBERTSON) Certainly. The number one thing is when you find out what the resource needs, make regulations in a form that can be enforced. That sounds simple, but you can pass all the laws in the world and if they're not understandable to the public and enforceable by the wardens, they don't accomplish your management goals. So make regulations simple, understandable and enforceable.

Q: SPOTTED SEATROUT FIRST REPRODUCE AT 12-14 INCHES IN LENGTH. WHETHER A FISH IS 14 INCHES OR 28 INCHES, GENES FOR LARGE SIZE, IF INHERITABLE, WILL BE PASSED ON. SO WHY REGULATE FOR LARGE SIZES OTHER THAN IN TERMS OF QUANTITY?

A: (POAGE) Remember that G.C.C.A. has no biologists on staff. Studies being done at present hopefully will give us more information on whether or 28- or 30-inch trout is capable of reproducing or are the real producers vs. an 18-, 20- or 22-inch female trout. How many times a year do they spawn? Do they spawn twice a year? Are those 28-32-inch female trout capable of continued spawning, however old that fish might be?

Q: DO YOU FEEL THAT THE GENERAL PUBLIC HAS A PHOBIA OF EXOTIC FISH SPECIES?

A: (KLEPPER) No, I think members of T.B.B.U. have a phobia about exotic fish species.

Q: IN YOUR OPINION DO TILAPIA HELP OR HINDER THE BASS POPULATIONS IN TEXAS RESERVOIRS? YOU MENTIONED THAT LAKE BRAUNIG BASS HAVE A WR OF 150. DOES THE LARGE POPULATION OF TILAPIA IN THE LAKE CONTRIBUTE TO THIS?

A: (ANDERSON) I think a lot of the private producers will document the effectiveness of tilapia as a species of prey being consumed by largemouth bass. Studies on food habits of largemouth bass in Braunig have shown tilapia is an important species of prey. I'm encouraged by the fact that for 10 years there was no evidence of successful reproduction of largemouth bass in Braunig. At least in my own mind I would like to believe that the conservative regulations on harvest of largemouth bass has resulted in a buildup of bass biomass and as subsequent reduction in the biomass of tilapia. I see now that in recent years there has been successful reproduction. I look at a resumption of successful reproduction of largemouth bass in Braunig in association with a reduction in the biomass of tilapia. I would like to believe that might be what is happening. If you have too many threadfin shad, gizzard shad, bluegill, crappie or whatever, you're not going to have good bass reproduction. With adequate regulation of bass harvest on top of that surplus of prey, I expect much better success with largemouth bass reproduction.

Q: YOU NEGLECTED TO MENTION THAT YOUR ORGANIZATION WAS ALSO ORIGINALLY OPPOSED TO HARVEST REGULATIONS ON BLACK BASS. WHY?

A: (ROGERS) I assume this question is referring to the 5-fish, 14-inch limit. We did not object to those regulations. We requested from the Texas Parks and Wildlife Commission a 7-fish, 14-inch limit because at that time the interpretation of the culling law was that once you harvested a fish and retained it in your live well or on your stringer, you could not cull or replace that fish with a larger fish if you caught one later. That is the reason we asked for a 7-fish, 14-inch limit. We asked the Commission at that time to repeal or revise the culling law, and were told they wouldn't. About 2 weeks later, after the press picked up on this, they came out with the interpretation that you could cull a fish from your live well or stringer as long as it was released alive and healthy. The 5-fish, 14-inch limit will give you virtually the same poundage as a 10-10. The only thing is the 5-14 would inhibit a lot of tournament fishing if you couldn't cull. That's the reason we asked for a 7-fish instead of a 5-fish limit.

Q: HOW MUCH INFLUENCE DOES AN ORGANIZATION, SUCH AS T.B.B.U. OR PUBLIC COMMENT AND OPINION STIRRED UP BY THE MEDIA, HAVE ON WHAT TYPE OF REGULATION IS APPLIED TO A GIVEN BODY OF WATER (I.E., CAN NEGATIVE/POSITIVE PUBLIC OPINION CAUSE A PROPOSED REGULATION TO BE REMOVED DESPITE BIOLOGICAL EVIDENCE FOR IT)?

A: (OSBORN) The quick answer is absolutely yes, it can. Part of that has to do with management objectives for the Fisheries Division, which is to obtain optimum yield for each of its fisheries. So what is optimum yield? Its some number modified by ecological considerations, economic considerations and social considerations. Its very difficult to quantify. Social considerations means the people can have their input through the public hearings, the media, the comments they send in, the phone calls. We're mandated to consider that social aspect. We should and we do. I'll give you an example. Organizations can make known social desires the managers weren't necessarily aware of. We do mail surveys and on-site interviews asking what people want. We work with sociologists at universities to tell us how to find out what people want. When it comes time to have a regulation, you get instant feedback. A very recent example is that, based on biological considerations, the National Marine Fisheries Service requested that Texas should have a 1-shark bag limit. We had very little information on our shark fisheries, so we proposed to the Commission a 1-shark bag limit, because that's what the biology said was appropriate. They got a lot of public feedback saying that wasn't wanted. There was a large group of people who were opposed to the proposal, so the Commission changed to a 5-shark bag limit. So social input, through various media sources and individuals themselves and groups, certainly make a difference and we welcome that input.

Q: THE NEED FOR REGULATIONS IS ONE THING, AND DR. ANDERSON IS VERY CONVINCING FROM A BIOLOGICAL VIEWPOINT, BUT HOW DO WE ORGANIZE THEM, SIMPLIFY THEM AND COMMUNICATE THEM TO ANGLERS, MANY OF WHOM HAVE LITTLE TOLERANCE FOR COMPLEXITY DURING THEIR LEISURE?

A: (ANDERSON) It's not easy. The easiest system obviously is one of uniform statewide regulations. That's the easiest system to communicate to the public and to enforce. To have variability (custom regulations) is difficult. It takes much more effort. I think it takes a higher level of biological expertise and predictability. It takes a higher level of professionalism to be able to work with your local agents, to be able to work with the judiciary, to be able to work with the local representatives of your interest groups, whether it's G.C.C.A. or T.B.B.U. It's a lot more work to do an effective job of regulating harvest. It's not easy. It takes effort to get the message out to the public and to get the support necessary to do it successfully.

Q: HOW DOES THE TEXAS PARKS AND WILDLIFE DEPARTMENT KEEP WARDENS ON THE LAKES AND OUT OF THE DEER WOODS IN THE FALL, ESPECIALLY IN LIGHT OF THE MONEY SPENT FISHING VS. HUNTING?

A: (ROBERTSON) Simply, during the fall, more people go deer hunting than fishing at certain times. We have got to send our people where the activity is, whether it's fishing or hunting.

Where I worked, around Corpus Christi, the fall and winter time was not our deer hunting season, so I was on the water. A game warden in Mason or Llano County would be in the woods. We may even send some wardens from the coast to those Hill Country counties during that particular peak season. Then when the spring shrimp season opens, we'll bring some of those people from the Edwards Plateau to the coast to check the shrimpers. So we've got to push our force around to try to cover the peak activity at the peak times. It's not easy.

Q: IF THE TEXAS PARKS AND WILDLIFE DEPARTMENT MUST HAVE A SINGLE SIZE LIMIT FOR MOST LAKES, WHAT WOULD THE BEST LIMIT BE?

A: (ANDERSON) I would say if there is a need for uniform statewide regulations on harvest of largemouth bass, my expectation would be that a slot would be the proper approach; it might be more effective than a 14-inch minimum. I asked when the 14-5 was proposed, are there going to be lakes that begin to develop a surplus of bass under 14 inches? This was based on experience in Missouri where at Pomme de Terre Reservoir, under a 15-inch minimum, the bass catch rate kept going up averaging year round one bass per hour (which is a pretty outstanding catch rate on bass in a large reservoir), yet the proportion of legal bass was going down. That has happened in many waters where the minimum length limit was set at 12, 14 or 15 inches. If or when that situation develops, and my prediction is it will happen on a certain number of reservoirs in Texas, what's the next step? I have not had that question answered yet today. A slot prevents that from happening.

Q: WHAT IS THE MINIMUM FOR GOOD RECRUITMENT TO SUSTAIN GOOD FISHING IN POUNDS/ACRE?

A: (ANDERSON) The minimum poundage of bass needed for good recruitment is based on the productivity of the water. You need a higher poundage of bass in productive waters than in unproductive waters. You need a much higher poundage of bass in a lake which has tilapia or the potential to produce stunted populations of crappie. Its hard to answer, but generally for fish of a quality size, 20-40 pounds/acre will give you good recruitment year after year.

Q: IN GENERAL, WHAT KIND OF REGULATIONS WOULD BE MOST EFFECTIVE IN MAXIMIZING CATCH (NOT HARVEST) OF TROPHY-SIZED BASS?

A: (ANDERSON) It all depends on the situation. If its a high density bass population and you want to catch trophy bass, you better crop a very high proportion. If you're having high reproductive success you better reduce bass density down pretty severely in order that the fish that are left are growing at a maximum rate and having a surplus of available prey, if your objective is to produce trophies. But a trophy is a very hard

fish to catch, typically 0.000 something percent of the total bass in the state are of trophy proportions. They are trophies because they are rare and I question whether producing trophy fish should be a management objective in public waters because one trophy fish satisfies too few anglers on too few trips. The quality of fishing is based on fish of preferred and memorable sizes, 15 or 18 inches and larger.

Q: GIVEN THE DISPARITY IN PAY BETWEEN GAME WARDENS AND FISHERIES BIOLOGISTS, WOULD YOU STILL CONSIDER BEING A FISHERIES BIOLOGIST?

A: (ROBERTSON) When I graduated, not being able to get a job as a fisheries manager for Texas Parks and Wildlife Department, I went to work for a chemical company in Channelview as a water chemist, running their water effluents in a lab as shift work. I was making \$800/month and thought I was in hog heaven. But when I got a chance to go to the Texas Parks and Wildlife Department, I took a job as a game warden cadet at \$410/month (1970). We haven't always been paid that well. My first pay raise as a Game Warden I was to \$525/month and I still would do that because I enjoy it. We appreciate any consideration we can get in the Legislature, which I'm sure you would too. I don't know if I can defend it or not, but I think we're worth every penny of what we get.

RELATIONSHIP OF RELATIVE WEIGHT (WR) TO PROXIMATE
COMPOSITION OF JUVENILE STRIPED BASS AND
HYBRID STRIPED BASS

by

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Abstract

The relative weight (Wr) index is commonly used to assess condition of fish. However, little is known about the relationship of Wr to the actual physiological condition of fish. Whole-body proximate analysis quantifies the general chemical composition of fish, but is impractical and too costly for large-scale application to natural populations. Relative weight may offer an alternative method to estimate composition of fish. In the present study juvenile striped bass Morone saxatilis and hybrid striped bass M. saxatilis ♀ x M. chrysops ♂ were raised under controlled conditions for a 12-week period and then sacrificed in order to determine proximate composition. Analysis of linear relationships between Wr and proximal components indicates Wr may be used for estimating body composition and gross energy in juvenile striped bass and hybrid striped bass; Wr was well correlated with percent crude fat, crude protein, ash, visceral fat, and ash-free dry-weight gross energy. Additionally, Wr was correlated with relative growth and the change in total length for the experimental period. Reserve energy, i.e., visceral fat, predicted from Wr may provide a measure for overwintering fitness and perhaps prestocking suitability of juvenile striped bass and hybrid striped bass.

MANAGEMENT APPLICATION OF ANGLER RECOGNITION
PROGRAM DATA

by

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Abstract

This report presents information collected from two angler recognition programs administered by the Texas Parks and Wildlife Department and discusses their value for evaluating management strategies directed toward the production of large fish. Information from all Texas State Fish Records and Big Fish Awards applications received since the programs began in 1970 and 1974, respectively, were analyzed to determine changes in number and weight of fish submitted each year. Frequent increases in largemouth bass Micropterus salmoides (five in a 6-year time span), striped bass Morone saxatilis (eight in a 14-year time span), and hybrid striped bass M. chrysops x M. saxatilis (seven in an 8-year time span) state records were documented. Significant annual increases in mean weight of largemouth bass (4.0 kg in 1974 to >5.0 kg in 1986 and 1987) and smallmouth bass M. dolomieu (2.2 kg in 1979 to 2.6 kg in 1987) certified for Big Fish Awards were recorded. Increases in size of largemouth bass and striped bass certified were directly related to stocking programs. Despite limited participation in the Texas angler recognition programs, data indicate fishing quality has improved for largemouth bass, smallmouth bass, and striped bass as a result of our stocking activities.

HATCHERY BROODSTOCK CERTIFICATION

by

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Abstract

The Fish Hatchery Branch of the Texas Parks and Wildlife Department has implemented a broodstock certification program for Florida largemouth bass Micropterus salmoides floridanus, striped bass Morone saxatilis and white bass M. chrysops. Certification of largemouth bass brood fish requires a liver biopsy followed by agarose gel electrophoresis of diagnostic loci. Once the genotype is identified, a passive integrated transponder (PIT tag) allows permanent identification of selected fish. Certified fish are then used to create stocks of genetically marked fish. Striped bass and white bass brood fish are captured in the wild and their genetic purity is sometimes questionable. Certification of Morone spp. is accomplished using isoelectric focusing of discriminatory sarcoplasmic proteins. Brood fish can be certified prior to the hatching of larvae which insures only genetically pure fish are stocked. The techniques currently employed with Florida largemouth bass, striped bass and white bass have the potential to be useful in genetic management of many of the other species propagated by the Fish Hatchery Branch.

TECHNIQUES FOR COLLECTING, PREPARING, AND
MOUNTING CATFISH SPINES

by

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Abstract

This study describes workable techniques for collecting, preparing, and mounting catfish pectoral spines for age and growth determination. Spines were collected concurrent with routine gill net surveys. Spines were prepared by boiling in water, then cleaned with a dissecting probe and toothbrush. Spines were embedded in clear casting resin and cross sectioned on the distal side of the basal recess. Cross sections were dipped in clearing oil and mounted on a glass slide. The magnified image of the spine was used to discern annuli for age determination.

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RELATIONSHIP BETWEEN FEEDING OF BLUEBACK HERRING AND
THE ZOOPLANKTON COMMUNITY OF A TEXAS RESERVOIR

by

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Abstract

Following the introduction of blueback herring Alosa aestivalis, we examined herring food habits and the crustacean zooplankton community in Lake Theo, a 30-hectare reservoir located on a tributary of the Red River in North Texas. Prior to the introduction in spring, 1982, the reservoir contained an established fish community dominated by centrarchids. Blueback herring stomachs and zooplankton were sampled quarterly from summer, 1982 through winter, 1985. Cladocerans accounted for 90% of the zooplankton consumed by herring. Median lengths of cladocerans and copepods in the herring diet were usually significantly greater than those in the reservoir. No appreciable changes in lengths of cladocerans and copepods in the reservoir were observed after blueback herring introduction, but the zooplankton community shifted from cladoceran to copepod domination.

BEHAVIOR OF INTRODUCED RED DRUM AND HABITAT-USE OVERLAP
WITH LARGEMOUTH BASS IN A POWER-PLANT COOLING RESERVOIR

by

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Abstract

The introduction of a non-native species into an aquatic community is a fisheries management practice that has caused considerable debate due to concern over possible effects of interspecific competition upon resident fish populations. The recent introduction of red drum Sciaenops ocellatus into a Texas reservoir provided an opportunity to observe this euryhaline species' behavior in a freshwater system, as well as to evaluate the potential for post-stocking interspecific competition between an introduced predator and a resident predator, in this case largemouth bass Micropterus salmoides. Habitat use, temperatures occupied, and seasonal distribution of red drum and habitat-use overlap with largemouth bass were ascertained in Lake Fairfield, Texas, using ultrasonic telemetry. Habitat-use overlap between the species was evaluated seasonally to determine if the potential for interspecific competition existed after the initial effects of introduction were established. Habitat use by each species varied seasonally, but tagged largemouth bass preferred the shoreline, cove and intake canal habitats overall; utilization of open water by this species was far below expectation based upon availability. Tagged red drum preferred open water habitat throughout the study and the effluent cove during autumn and winter seasons; other habitats were used less than expected. Habitat-use overlap between the two species was minimal with the greatest overlap occurring during the winter, but overlap was probably not extensive enough to contribute to significant competitive interaction between the species. Red drum distribution varied in range and proximity to the effluent discharge with season. Red drum tended to avoid the hot-water effluent during the spring and summer; during the late autumn and winter, the red drum were more closely associated with the effluent. It is hypothesized that this seasonal distribution was more prey-dependent than temperature-dependent. A temperature occupation range was determined seasonally for each species.

SMALLMOUTH BASS IN LAKE TEXOMA: A CASE HISTORY

by

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Abstract

The development of a smallmouth bass Micropterus dolomieu fishery in Lake Texoma after the species was introduced in 1981 was studied. Survival of stocked smallmouth bass was confirmed in 1982 and reproduction documented in 1985. Relative abundance increased four-fold from 1982 to 1988. Smallmouth bass were initially collected near stocking sites, but by 1988 were collected up to 12 km from those sites in areas with habitat characterized by rip-rap or large rocks. Their diet consisted of fish (73%, primarily sunfish Lepomis spp.), crayfish (22%), and insects (6%). Growth of smallmouth bass older than age 2 was equal to, or exceeded, that reported for other smallmouth bass populations. A self-sustaining fishery developed and by 1988 anglers were actively seeking smallmouth bass and catching fish in excess of 2.75 kg.

RETENTION OF THREE NATURAL BAITs ON TROTLINEs
IN THE LAGUNA MADRE, TEXAS

by

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ABSTRACT

The objective of this study was to compare retention of shrimp (Penaeus spp.), crab (Callinectes spp.) and oleander leaf (Nerium sp.) baits on top and bottom trotlines set in the upper and lower Laguna Madre. The Texas Parks and Wildlife Department conducted a trotline study in the upper and lower Laguna Madre during February 1985-January 1986. Three bait types were examined-crab legs, dead shrimp and oleander leaves. Number of hooks containing bait were counted with each trotline pickup. A four factor (bait, season, position fished, bay system) fixed-effects model analysis of variance was used to determine differences in percent of baits left after each set. Oleander leaf baits had highest retention (81.0%), followed by crab (76.7%) and shrimp (3.5%). Percent of baits left were similar among seasons and between position fished but were significantly different among bait types and between bay systems.

Introduction

Prior to 1981, the Laguna Madre produced 50% of the Texas commercial finfish harvest (Hamilton 1981). An extensive trotline fishery developed in the Laguna Madre and by the early

1950's trotlines accounted for the majority of reported commercial finfish landings (McEachron et al. 1985; Hamilton and Saul 1984). Spotted seatrout Cynoscion nebulosus and red drum Sciaenops ocellatus were the target species. When commercial retention of these species was prohibited in September 1981, anglers shifted their emphasis to black drum Pogonias cromis.

Durability of trotline baits has management implications. Because durable baits fish longer, a relationship exists between the durability of a trotline bait and its effectiveness (Martin et al. 1987b). Harrington (1970) noted that plastic baits were extremely durable and continued fishing even when the trotline was no longer tended. Plastic trotline baits were banned in September 1974 in an effort to reduce the harvest of red drum and spotted seatrout (McEachron et al. 1980).

The Texas trotline fishery has been studied extensively. Previous Texas Parks and Wildlife Department (TPWD) trotline studies evaluated the commercial trotline fishery, compared trotline catches by hook type and examined survival of trotline caught fishes (McEachron et al. 1985, 1986; McEachron et al. 1987; Martin et al. 1987a). Trotline baits were examined by McEachron et al. (1980), McEachron et al. (1987) and Martin et al. (1987b). Bait retention was addressed by Martin et al. (1987b).

The object of this study was to compare retention of shrimp (Penaeus spp.), crab (Callinectes spp.) and oleander leaf (Nerium sp.) baits on top and bottom trotlines set in the upper and lower Laguna Madre.

Methods

The TPWD conducted a trotline study in the upper and lower Laguna Madre (Figure 1) during February 1985-January 1986 (Martin et al. 1987a). Trotline descriptions and sample procedures were as described in McEachron et al. (1985). Trotlines were set in two positions (Figure 2): top (mainline on or just below the surface) and bottom (mainline on or just above the bottom). Six 100-circle hook trotlines were set overnight three times each month in both the upper and lower Laguna Madre. Three bait types were used: crab legs, dead shrimp and oleander leaves (McEachron et al. 1985). The number of empty hooks (no trace of bait) was recorded with each trotline pickup.

A four factor, fixed-effects model analysis of variance (AOV) was used to determine differences in mean number of baits left on hooks after soak time. The proportion of hooks containing bait at trotline pickup (P) was transformed using arcsine \sqrt{P} . The four factors were 1) bait: crab, shrimp and leaves; 2) season: spring (March-May), summer (June-August), fall (September-November) and winter (December-February); 3) position: top and bottom, and 4) bay system: upper Laguna Madre and lower Laguna Madre. Differences in main effects were evaluated with Duncan's multiple range test. When significant

first-order interactions were found, comparisons were made within levels of the interacting factors using the mean square error (MSE) from the AOV. Mean percent of retained baits were back transformed for presentation in the text (Quenoville 1950):

$$\text{backmean} = (\sin \bar{t})^2 + (\cos 2\bar{t})(1 - e^{-2s^2})/2$$

where

\bar{t} = the transformed mean;

s^2 = the variance of the transformed observations.

SAS procedures (SAS Institute, Inc. 1980, 1982) were used for all analyses; the significance level was $P \leq 0.05$.

Results

Percent of baits left on trotlines after soak time were similar among seasons (fall 50.8%, winter 53.3%, spring 50.2%, summer 49.6%) and between position fished (top 49.6%, bottom 51.9%) but were significantly different among bait types and between bay systems (Table 1). Oleander leaf baits had highest retention (81.0%), followed by crab (76.7%) and shrimp (3.5%). Trotline bait retention was higher in upper Laguna Madre (54.1%) than in lower Laguna Madre (47.3%). Significant two-way interactions of the percent of baits left were observed in bait x position, bay system x position, season x bait and bay system x bait (Figure 3).

Discussion

Regulations restricting oleander leaf and shrimp baits on trotlines would reduce incidental by-catch of red drum and spotted seatrout and impact black drum harvest minimally. Catch of spotted seatrout on crab legs is minimal (McEachron et al. 1987). Red drum are caught on crab legs (McEachron et al. 1987) but survival of trotline caught-and-released red drum is high (Martin et al. 1987a). Crab legs are the best trotline bait for black drum. Crab is a food item of black drum (Martin 1979). Crab legs have a hard exoskeleton that increase its "hook life". Shrimp have a thin exoskeleton and are easily picked off the hook by forage species such as pinfish Lagodon rhomboides, hardhead catfish Arius felis and silver perch Bairdiella chrysoura. At certain times of the year, especially winter, red drum are caught in high numbers on shrimp (McEachron et al. 1987). Black drum are caught to a lesser extent on shrimp (McEachron et al. 1987). Although oleander leaves had highest on-line retention, catch of

black drum was low (McEachron et al. 1987). Oleander leaf baits are most effective for catching red drum (McEachron et al. 1987).

More baits left on hooks in upper Laguna Madre is probably due to fish being less abundant in upper Laguna Madre (Rice et al. 1987) and is responsible for the significant two-way interaction of position x bay system. Significant interactions show that main effects do not operate independent of one another. Interactions also reveal differences within main effects. Significant two-way interactions in bait x position and season x bait indicate baits behave differently between seasons, position fished and bay system.

Acknowledgments

We would like to thank all Laguna Madre field personnel who collected the samples. Maury Osborn, C. E. Bryan, Robin Riechers, Paul Hammerschmidt, Tom Heffernan and Lynn Benefield reviewed the manuscript.

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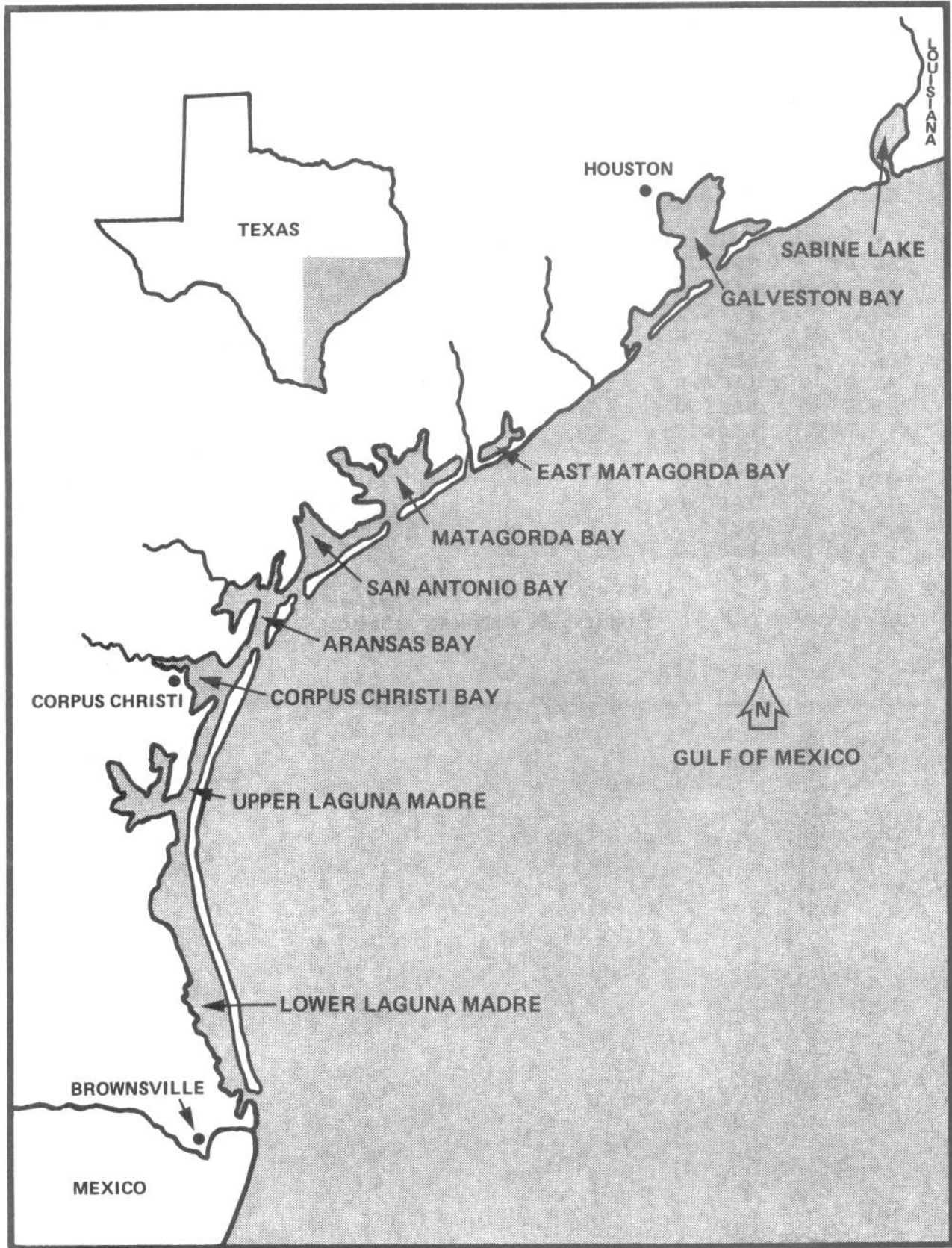
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Table 1. Summary of four-way analysis of variance, after arcsin transformation of data, of the mean number of baits left on top and bottom trotlines in the upper and lower Laguna Madre during February 1985-January 1986.

Source of variation	df	Sum of squares	F
Total	422	140.9205	
Bay system	1	1.8349	30.88*
Season	3	0.2712	1.56
Bay system x season	3	0.3478	2.00
Position	1	0.2341	4.03
Bay system x position	1	0.2703	4.65*
Season x position	3	0.1331	0.76
Bay system x season x position	3	0.1160	0.67
Bait	2	112.2013	965.57*
Bay system x bait	2	0.5368	4.62*
Season x bait	6	1.7279	4.96*
Bay system x season x bait	6	0.3241	0.93
Position x bait	2	0.6154	5.30*
Bay system x position x bait	2	0.2566	2.21
Season x position x bait	6	0.1069	0.31
Bay system x season x position x bait	6	0.1561	0.45
Error	375	21.7879	

* $P \leq 0.05$

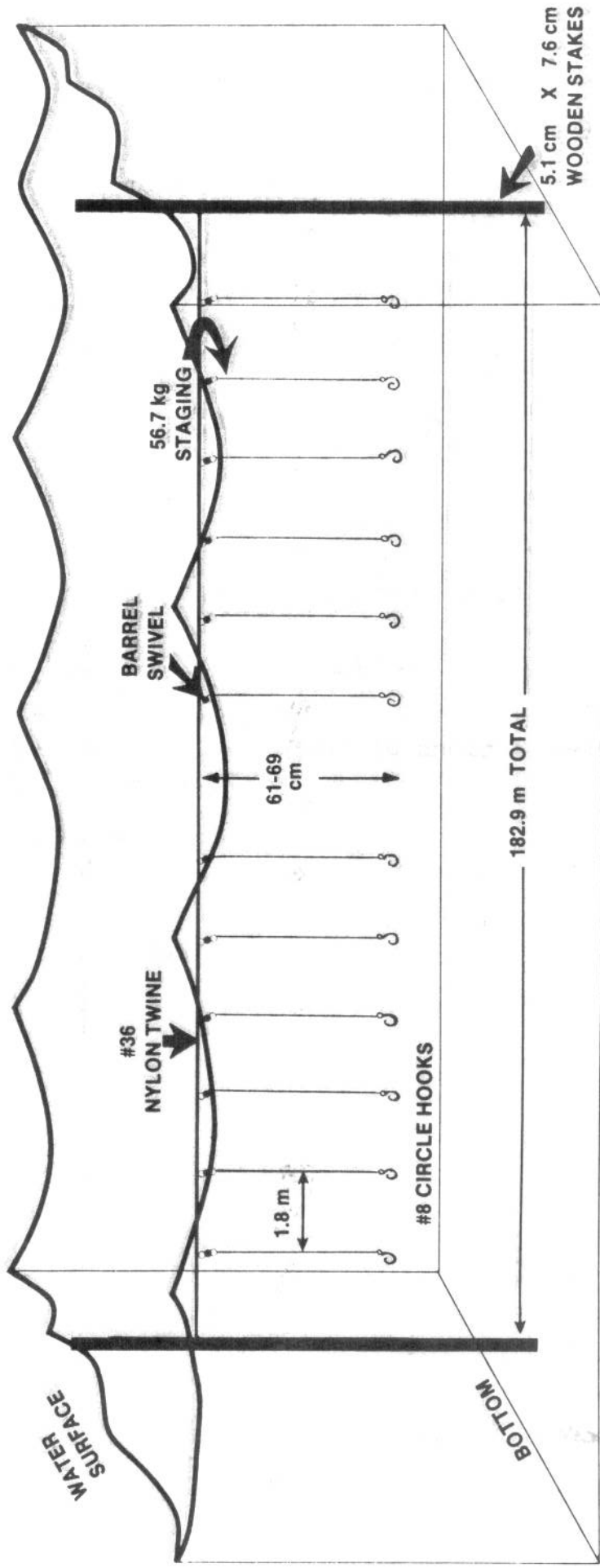
Figure 1. Texas coast.



FOUR STAKES
10' x 10' x 10'



Figure 2. Descriptions of trotlines, surface and bottom sets.



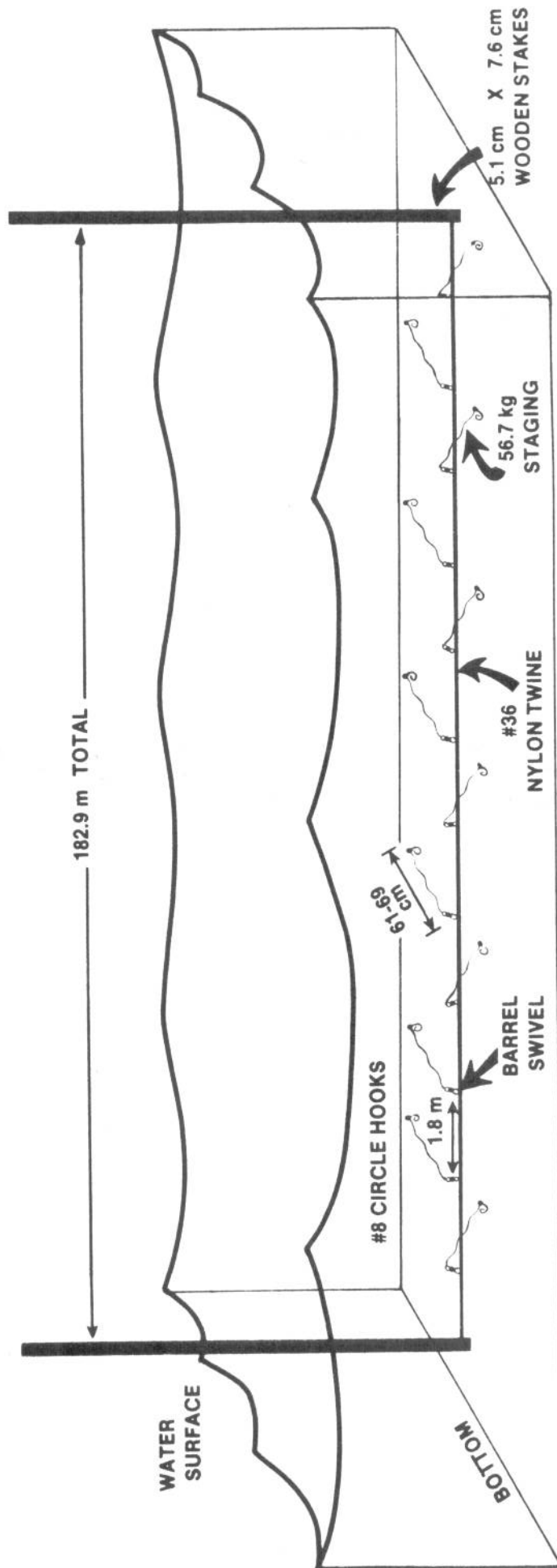
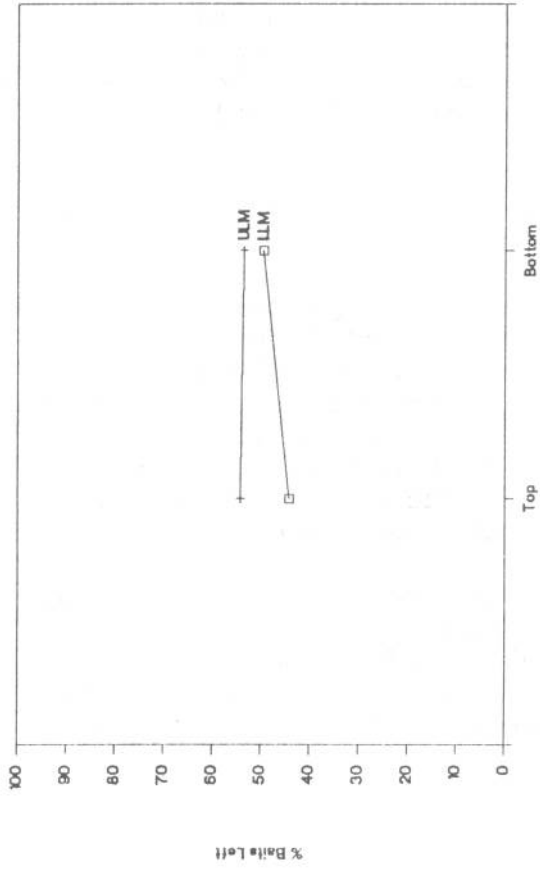
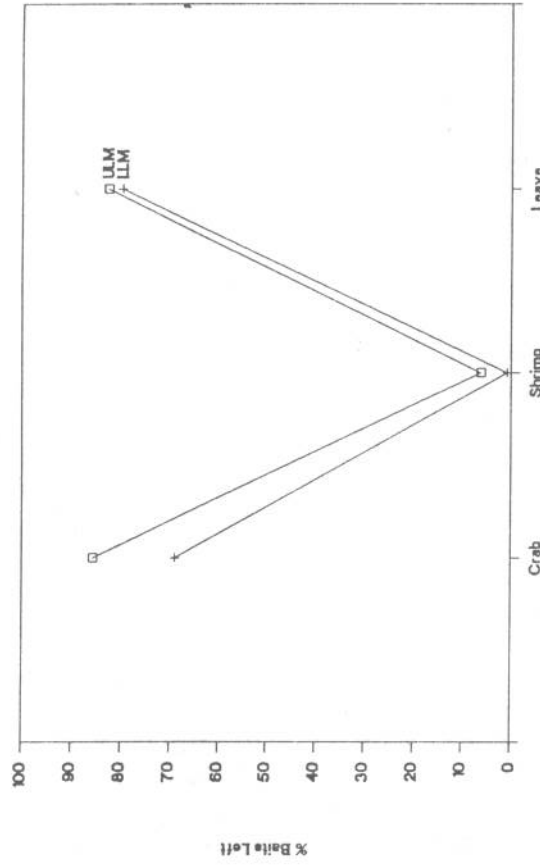


Figure 3. Significant two-way interactions of back-transformed mean number of baits left per trotline among bait type, bay system, season and position fished.

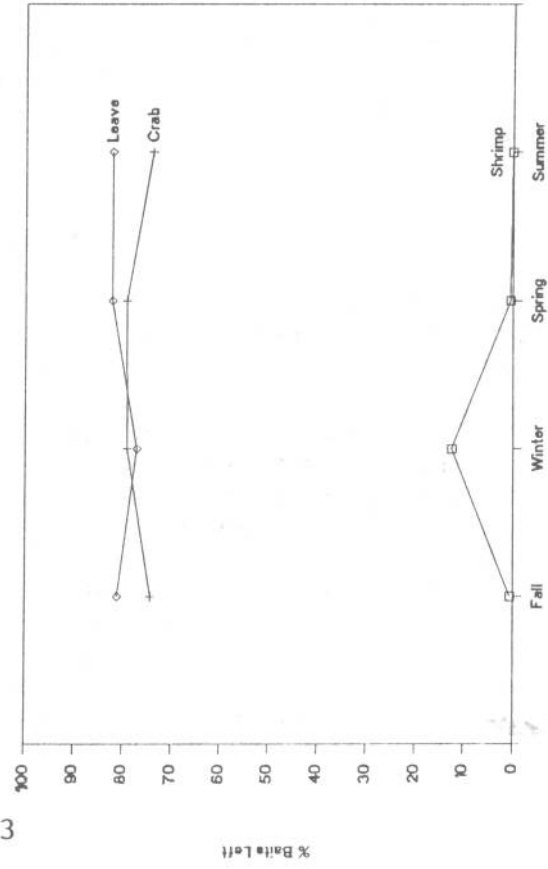
Bay System x Position



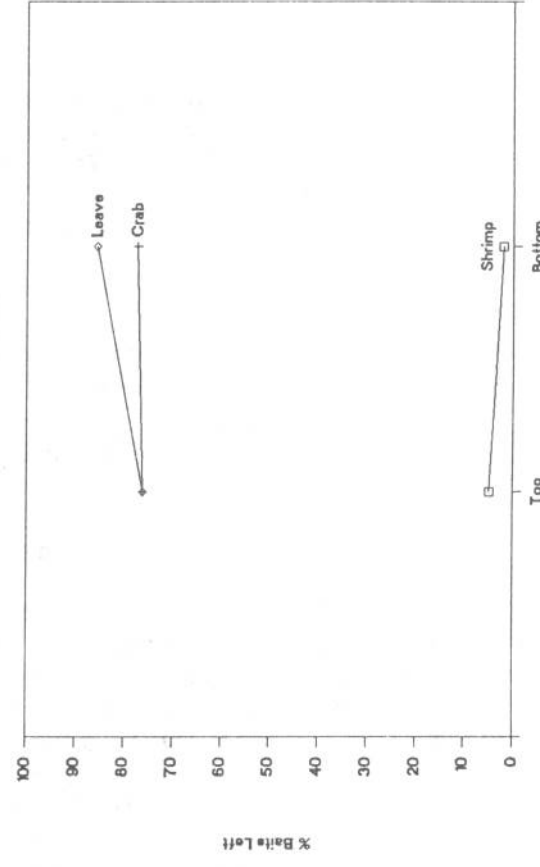
Bay System x Bait



Season x Bait



Bait x Position



THE FIRST YEAR OF THE TEXAS PADDLEFISH RESTORATION PROGRAM

by

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Abstract

In the first year of Texas Parks and Wildlife Department's Paddlefish Restoration Program, 30,861 paddlefish Polyodon spathula fingerlings were stocked into the upper reaches of B. A. Steinhagen Reservoir. Production of these fingerlings at the A. E. Wood Fish Hatchery was the result of a multi-state cooperative effort to restore paddlefish populations to self-sustaining levels. Techniques for broodstock capture, spawning and hatching and rearing of fingerlings have been developed and applied by the Missouri Department of Conservation and the South Dakota Department of Game, Fish and Parks. Stocking of fingerlings into depleted populations has been an effective practice. Significant advances were made in intensive culture in Texas in 1989. Current methods for culture of fingerlings and results of 1989 efforts are discussed.

Introduction

The natural range of paddlefish Polyodon spathula has been reduced by dam construction, channelization and flood control measures along the larger river systems of the Mississippi drainage. These alterations have blocked spawning runs, modified flow regimes and inundated spawning substrate, resulting in the loss of natural reproduction (Carlson and Bonislavsky 1981). By the time spawning requirements were understood and protective measures enacted, many natural populations were depleted or eliminated.

Insufficient natural recruitment requires that fingerlings be stocked to augment natural reproduction. Paddlefish populations can be maintained and established by stocking hatchery produced fingerlings (Graham 1986). For example, the anticipated decline of paddlefish numbers in Missouri due to the

construction of the Harry S. Truman Dam has been avoided by the stocking of fingerlings. Harry S. Truman Dam completely blocked spawning migrations of paddlefish trapped in the Lake of the Ozarks. Filling the reservoir inundated all known spawning habitat above the dam. In the Lake of the Ozarks, annual stockings of about 14,000 fingerlings has maintained a fishery (Graham 1988). Annual stockings of about 15,000 fingerlings into Harry S. Truman Reservoir have proved so successful that a limited sport fishery was established (Graham 1988). In addition, an extremely popular sport was created in southwestern Missouri by stocking an estimated 83,000 fingerlings over a 6 year period into Table Rock Lake on the James River (Graham 1986). Catch curves have demonstrated that fingerling stockings can strongly influence harvest and recruitment in subsequent years (Graham 1988).

Techniques for fingerling culture have developed to a point where recovery of populations in Texas is promising. By stocking fingerlings into remaining habitat, an eventual recovery of paddlefish populations should lead to its removal from the state's endangered species list.

Culture Methods

Shortly following Purkett's (1961) initial observations of spawning, artificial spawning and rearing of paddlefish was initiated. Initially, adults were taken during the regular snagging seasons. Spermiation was successfully initiated in males by injecting carp and paddlefish pituitary extracts. Obtaining viable eggs from females, however, was more problematic. Naturally spawning females release small quantities of eggs over a 24-hour period. Some success in stimulating synchronous ovulation was achieved by injecting pituitary extracts, but hand stripping produced only very small quantities of eggs (Needham 1965; Unkenholz 1977; Russell et al. 1980). Recently, techniques solving some of these initial problems have been developed.

Broodfish Capture

Female paddlefish reach sexual maturity at 10-13 years and males mature at 7-10 years (Graham et al. 1986). Males may spawn annually but females are reported to spawn only once in 4-7 years. Reservoir fish usually mature faster and spawn more frequently than river fish (Russell 1986). In Missouri, South Dakota and North Dakota, brood fish are currently captured annually from the wild for artificial spawning and later released. No hatchery program for maintenance and conditioning of paddlefish broodstock has been reported.

Broodfish are collected in the spring in deep-hole staging areas of main river channels before a spawning run, at tailraces of dams where they are blocked and congregate during the spawning run, or when they move into shallow gravel beds to spawn (Russell

1973; Graham et al. 1986; Copper 1988). Gill nets (102-152-mm mesh) are the most common method of collection. Floating gill nets are used in swift, shallow waters. Deep set gill nets are used to capture broodfish from deep-hole staging areas. Paddlefish trapped in gill nets succumb quickly because they cannot adequately ventilate their gills; therefore, nets are checked frequently. Electrofishing has been used to capture brood fish, but results in high mortality. When nets are not appropriate, fish can be snagged.

There are no reliable external differences between the sexes of adult paddlefish, but gravid females usually have more extended abdomens than males. If females are near ovulation when captured, they will have swollen vents from which a few eggs can be obtained. Mature fish generally range from 11 to 50 kg but fish ranging from 13 to 18 kg are easiest to handle. Fish this size tolerate handling and are easily controlled by grasping the caudal peduncle in one hand and rostrum in the other. Paddlefish are transported to a hatchery prior to spawning and held in large round tanks to allow continuous swimming and adequate ventilation (Graham et al. 1986).

Artificial Spawning

Techniques developed for white sturgeon have been applied to paddlefish egg procurement (Hamilton 1989). The appropriate time for hormone injection is judged by taking a small number of eggs surgically for examination. If ova are determined to be near maturity, hormone injections can proceed. LHRH has produced the most consistent results in obtaining both eggs and sperm. After hormone therapy (0.1 mg/kg), females usually begin ovulation within 15 to 18 hours.

Eggs are removed surgically by making a 76-mm incision in the abdomen of the fish and scooping eggs from the body cavity. Fish are placed on their backs on a stretcher for the procedure. Fish are ventilated by running water with a hose under the opercular flaps into the buccal cavity. No anesthetization is necessary during the procedure. Ovaries comprise 15 to 25% of the body weight and an 11- to 25-kg female will yield about 200,000 to 500,000 (2.4-4.0 kg) eggs (Graham et al. 1986).

Once eggs are removed, they are fertilized with refrigerated sperm and stirred for 3 minutes. Fullers earth, a commercial clay suspension, is then added to prevent clumping because eggs are adhesive once fertilized. Eggs are then stirred for an additional 15 minutes. Fertilized eggs are washed of excess Fullers earth and allowed to water harden for 1 hour prior to incubation. Fertilized eggs are 3-4 mm in diameter and light grey to black in color. After 48 hours, eggs can be transported by air in standard plastic bags and styrofoam containers for up to 5 hours at constant temperature while still maintaining good hatching success.

Egg Incubation and Hatching

Eggs are incubated for 48 hours in McDonald jars at a slow water flow to prevent damage to the embryo during gastrulation and neurulation. After this period eggs are rolled vigorously until hatching. Fungus can be a serious problem. Eggs with fungus and nonviable eggs should be syphoned off regularly to prevent contamination of healthy eggs. Methylene blue treatments aid in prevention of fungus (Brandt 1978), but sand filtered, ultraviolet treated water sources are a good alternative to chemical treatment. Eggs hatch in 5-7 days at 16 C but may require as long as 10-12 days at lower temperatures (Russell 1973). Hatching may continue for 3-5 days.

Fry hatch at a length of 8-9 mm with a large yolk sac. Fin, mouth and body development is rapid for the next 5 days. Fry begin feeding 5 days after hatching. Fry should be stocked in ponds for extensive culture or started on commercial feed for intensive culture. Fry can burn in bright sunlight and should be stocked into ponds in the evening or on overcast days (Friberg 1973). They can be air shipped or hauled in standard plastic bags and styrofoam containers for up to 6 hours with good survival and condition at densities of 500 per liter of water.

Fingerling Culture

Paddlefish grow extremely fast and require a large initial biomass of large cladocerans for adequate growth and survival in extensive culture situations. Other zooplankton types are too small or move too quickly for fry to catch (Michaletz et al. 1982). When fingerlings reach 120 mm (TL) they tend to move to the bottom of the pond where they also use benthic organisms and aquatic insects. At this time gill rakers are adequately developed and filter feeding begins, allowing additional exploitation of smaller cladocerans and copepods (Reulle and Hudson 1977; Russell et al. 1980; Burke and Bayne 1986). Survival and growth are achieved by heavy initial and repeated fertilization with organic fertilizers and by supplemental feeding with commercial feeds. In Missouri fry are stocked at 12,500/hectare to heavily fertilized ponds and fed frequently by blowing feed on ponds.

Paddlefish fingerlings in ponds are vulnerable to many common problems. Heavy fertilization and feeding require frequent monitoring of ponds to prevent low dissolved oxygen (4 mg/liter). Paddlefish are slow moving and their eyesight is extremely limited. Fingerlings are very vulnerable to all vertebrate predators, especially birds. They are also vulnerable to entanglement in aquatic plants and filamentous algae. Few disease problems have been reported in ponds, but fry are vulnerable to many common chemicals used for disease control (Graham 1986). Paddlefish must be harvested by slowly draining ponds at night to prevent mortalities from sunburn, heat and by impingement on drain screens.

Intensive culture of paddlefish fingerlings is a promising alternative to extensive culture because paddlefish readily

accept artificial diets. Food should be offered at frequent intervals because of extremely rapid growth. Fry feed in the water column and only food particles which fall within their limited range of vision are used. Neutrally buoyant feeds are currently unavailable. High protein commercial trout feeds have produced the most consistent results in intensive culture. Adequate saturation of the water column with feed requires the waste of a considerable amount of feed. When fingerlings attain 120 mm TL, they tend to move to the bottom of the container and use nearly all feed by filtering as they disturb settled feed. Large containers should be used for rearing to prevent frequent contact with the container walls which will result in damage to the developing rostrum and mortality. Strong currents should be avoided to prevent impingement of fry and fingerlings on drain screens.

First Year of Culture in Texas

Eggs and fry were supplied by Missouri, South Dakota and North Dakota for culture of fingerlings. Approximately 200,000 fry were air shipped from Missouri and stocked directly into six fertilized, 0.4-hectare ponds at densities of 12,500 to 14,500/hectare. An additional 315,000 eggs from Missouri, 490,000 eggs from South Dakota and 50,000 eggs from North Dakota were received and incubated in McDonald jars at 17 C. Upon hatch, 215,000 fry were stocked in five fertilized, 0.4-hectare ponds at a density of 13,000-22,500 fry/hectare; 60,000 fry were reared intensively indoors.

Pond production was disappointing. Five ponds produced no fingerlings. Only 3,005 fingerlings (200-250 mm TL) were harvested after 60 days from six other ponds. Fry that were air shipped from Missouri and stocked directly to ponds probably suffered from sunshock (Friberg 1973). Over fertilization of remaining ponds resulted in extremely low dissolved oxygen levels. Subsequent flushing with fresh water resulted in a large loss of nutrients and plankton biomass at a critically needed time. Ponds were supplemented with 4.5 kg of feed daily; however, this may not have been adequate. Initial numbers of cladocerans were very high but declined rapidly. In heavily stocked ponds, heavy feeding will be necessary to carry fingerlings from the time they exploit the cladoceran production potential until they begin filter feeding. Bird predation was also a significant factor in ponds once fish attained 102 mm TL. Fingerlings that were harvested from ponds were in excellent condition and tolerated handling well.

Intensive culture resulted in the production of 28,000 fingerlings (155-205 mm TL) in 60 days. Fish were fed a 50% protein commercial trout and salmon diet almost exclusively. Fry were found to survive and grow as well when reared exclusively on commercial feed as when started on plankton and converted to artificial feed. Fry were reared initially in 1,601-liter

circular tanks and rectangular troughs and moved to raceways after 2 weeks for the remainder of rearing. Intensive rearing of fingerlings requires large amounts of feed and is labor intensive, but paddlefish adapt well to such techniques and production appears to be very dependable (Kurten et al. 1989).

Fingerlings were hauled at densities of 1.32 fish/liter for 6 hours and stocked in the upper reaches of B. A. Steinhagen Reservoir. Crowding at such densities limits continuous swimming and ventilation and requires the maintenance of dissolved oxygen levels at a minimum of 10 mg/liter in hauling units.

Conclusion

The stocking of 37,000 fingerling paddlefish in 1989 represents significant progress toward the restoration of paddlefish populations in Texas. With the knowledge gained in intensive culture techniques, the production of paddlefish fingerlings should become routine and greatly increased.

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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 mentions 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; and
- 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; and
- 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.

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