

Mississippi

Louisiana



Joint Chapter Meeting



February 4-6th, 1998
Bay St. Louis, Mississippi

On the cover:

“THE JIGALOW”

NEW RELEASE

from the
Sport Fishing Collector Series
A Limited Edition



Marty Wilson ©



Marty Wilson grew up at his father's fishing camp on Point Cadet in Biloxi, trawling for shrimp and casting for specks. His work personifies the "Lady of the Gulf Coast" from her antebellum homes to her barrier islands. His disciplined attention to historical detail brings the past to life, and for a moment, you can imagine you were there.

Much to the delight of all who appreciate his work, Marty won numerous awards which have put him in the spotlight both locally and nationally. In previous years, he has successfully captured the flavor of the Gulf Coast through his winning poster renditions for the "Biloxi Seafood Festival," and the "Blessing of the Fleet." In recent years, several of Marty's paintings have been offered in limited edition prints, including the "Coastal History Collection," "Sport Fishing Collector Series," and "Shore Birds Collection." Each creative artistic achievement, no matter the medium, represents an extension of the artist, Marty Wilson.

"I was always taught, the pinnacle of life is to do what you love and love what you do and make a living at it. I don't think it can get any better than that. I have to do my art as much as I have to breathe. It is that important to my existence - I wouldn't know how to live out the rest of my life without it."

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PROGRAM OVERVIEW

WEDNESDAY - 4

- 3 :00 Room Check In (Hotel lobby)
5:30-7:00 Meeting Registration (*The Bridges*)
6:30 Social (*The Bridges*)

THURSDAY - 5

- 7:30 Set Up Posters (*Rose*)
8:00-5:00 Late Registration / Raffle Tickets (*Rose*)
8:00 Welcome / Announcements (*Magnolia*)
8:15 Coastal Fisheries -Technical Session I (*Magnolia*)
10:00 Break and Poster session (*Rose*)
10:15 Symposium "Habitat as a template for Fisheries" (*Magnolia*)
12:00-1:30 Lunch
1:30 Inland Fisheries- Technical Session II (*Magnolia*)
3:30 Break and Poster session (*Rose*)
3:45 Sturgeon - Technical Session III (*Magnolia*)
7:00 pm Dinner / Guest Speaker (*Sun*)

FRIDAY- 6

- 8:00 Chapter Meetings: MS (*Rose Room*) LA (*Magnolia*)
10:15 Aquaculture / Oysters -Technical Session IV (*Magnolia*)
10:00 Freshwater Ecology - Technical Session V (*Rose*)
11:45-1:00 Lunch
1:00 Aquaculture / Genetics-Technical Session VI (*Rose*)
1:00 Coastal Fisheries/Habitat-Technical Session VII (*Magnolia*)
2:45 Student Awards / Raffle (*Magnolia*)
3:30 Adjournment

MEETNG AGENDA

WEDNESDAY - 4

- 3:00 Room check in
5:30 - 7:00 Registration (*The Bridges*)
6:30 Social (*The Bridges*)

THURSDAY - 5

- 7:30 Set up Posters/ Late Registration (*Rose Room*)
8:00 **Welcome** (*Magnolia Room*) - Eric Dibble, *Program Chair*
Opening Addresses - Don Baltz, *Louisiana Chapter*

Technical Sessions: (*Number in parentheses denotes abstract page number)

COASTAL FISHERIES (*Magnolia Room*)

Technical Session I: Moderator - Rick Kasprzak, Louisiana Dept. Wildl. & Fisheries

- 8:15 Warren, J. Stock assessment of spotted seatrout (*Cynoscion arenarius*) in Mississippi coastal waters. (1)[#]
- 8:30 *Baker, Jr., M. S., C. A. Wilson, and D. Van Gent. Age validation of red drum, *sciaenops ocellatus*, from the Gulf of Mexico using analysis of Radium-226 and Polonium-210 in otoliths. (1)
- 8:45 Nieland, D. L., and C. A. Wilson. Age and size distribution of commercially harvested red snapper (*Lutjanus campechanus*) in the Northern Gulf of Mexico. (2)
- 9:00 Cuevas, K. J., M. V. Buchanan, W. S. Perret, and J. Warren. A comparison of blue crab catch in crab traps fitted with diamond excluder device vs. crab traps without. (2)
- 9:15 *deSilva, J. and R. Condrey. Profile of sharks associated with the U.S. Gulf menhaden fishery and their relevance to shark populations in the Atlantic Ocean and Gulf of Mexico. (3)
- 9:30 Franks, J. S. and N. Brown-Peterson. Preliminary examination of age and reproduction of wahoo, *Acanthocybium solandri*, from the northcentral Gulf of Mexico. (3)
- 9:45 Brown-Peterson, N. J., and J. S. Franks. A synchronous hermaphroditic striped mullet: to be male or female. (4)

10:00 - 10:15 **Posters & Coffee** (*Rose Room*)

SYMPOSIUM (*Magnolia Room*)

“Habitat as a Template for Fisheries” Moderator - Mark Peterson, Gulf Coast Res. Lab.

- 10:15 Opening comments - Mark Peterson
- 10:25 Keynote - Ross, S. and P. J. Schofield. Habitat and coastal marine fisheries: a review of the connections. (4)
- 10:45 Chesney, E., G. Thomas, and D. Baltz. Issues and trends in estuarine and coastal fisheries and fish habitats in Louisiana. (5)
- 11:00 LaSalle, M. W. An evaluation of a constructed marsh as suitable habitat for intertidal nekton. (5)
- 11:15 Fleeger, J. W. How habitat specific is feeding among animals that utilize the marsh edge? (6)

(SYMPOSIUM - continued)

11:30 ****VanderKooy, K. E., C. F. Rakocinski, and R. W. Heard.** The importance of estuarine submerged aquatic vegetation as a feeding habitat for bluegill, redear, and redspotted sunfish. (6)

11:45 Closing comments - Mark Peterson

12:00-1:30 **Lunch**

INLAND FISHERIES (*Magnolia Room*)

Technical Session II: Moderator - Charles Knight, Mississippi Natural Science Museum

1:30 Riecke, D., G. Lucas, and J. Russell. Treatment of coontail (*Ceratophyllum demersum*) at Bolivar County State fishing lake. (7)

1:45 George, S. G., J. J. Hoover, and K. J. Killgore. Diet of paddlefish in a Mississippi Delta Stream. (7)

2:00 Vyles, C. E., G. Lucas, J. Glahn, C. Sloan, and J. Maynor. Impact of cormorants on the crappie population of Lake Beulah. (8)

2:15 Whitrock, F. C. Legal considerations for fisheries management. (8)

2:30 Kasprzak, M. M. and G. Arcement. The use of real-time hydrographic monitoring data in fisheries management. (9)

2:45 Lucas, G. Rationale for removal of minimum length limits from Delta lakes. (9)

3:00 Holloway, H., D. Lavergne, and B. McManus. Characteristics and attitudes of Louisiana freshwater anglers. (10)

3:15 -3:30 **Posters and Coffee** (*Rose Room*)

STURGEON (*Magnolia Room*)

Technical Session III: Moderator - Neil Douglas, Northeastern Louisiana University

3:30 Reed, B. C. Paddlefish, sturgeon and CITES in Louisiana. (10)

3:45 *Wayman, W. R. and T. R. Tiersch. Development of methods for a sturgeon germplasm repository: blood collection. (11)

4:00 Killgore, K. J., J. J. Hoover, S. G. George, and W. Lancaster. Relative abundance and habitat utilization of pallid and shovelnose sturgeons in the lower Mississippi River.(11)

(STURGEON - *continued*)

- 4:15 Hoover, J. J., S. G. George, and K. J. Killgore. Morphomeric variation in shovelnose sturgeon and pallid sturgeon from lower Mississippi River. (12)
- 4:30 **Morrow, Jr., J. V., J. P. Kirk, and K. J. Killgore. Age, Growth, and Mortality of shovelnose sturgeon in the lower Mississippi River. (12)
- 4:45 **Adams, S. R., J. J. Hoover, and K. J. Killgore. Swimming endurance of juvenile pallid sturgeon. (13)
- 5:00 Kirk, J. P., K. J. Killgore, J. V. Morrow, Jr., C. Knight, and H. E. Rogillio. Status and future of the Pearl River Gulf sturgeon population. (13)
- 7:00 **Dinner** (*Sun Room*)
- 8:00 **Guest Speaker: Peter Floyd - "Perspectives of a Commercial Fisherman"**

FRIDAY - 6

8:00 - 10:00 **CHAPTER MEETINGS**

Mississippi (*Rose Room*)

Louisiana (*Magnolia Room*)

AQUACULTURE/ OYSTERS (*Magnolia Room*)

Technical Session IV: Moderator - Robert Romaine, Louisiana State University

- 10:15 Romaine, R. P., K. Belhadjali, and R. C. Reigh. Effects of supplemental feeding and rotational trapping on yield and size of crawfish in ponds. (14)
- 10:30 Paniagua-Chavez, C. G., J. E. Supan, J. Buchanan, and T. R. Tiersch. Performance of cryopreserved oyster sperms and embryos in the hatchery. (14)
- 10:45 Yu, G., Q. Zhang, C. Paniagua, and T. Tiersch. Naturally occurring banding in oyster chromosomes. (15)
- 11:00 *Kristensen, H. S., J. F. LaPeyre, and R. K. Cooper. Effects of protease inhibitors on the oyster pathogen *Perkinsus marinus* *in vitro*. (16)
- 11:15 *Buchanan, J. T., G. S. Roppolo, J. E. Supan, and T. R. Tiersch. Conditioning of eastern oysters in a closed, recirculating system. (16)
- 11:30 *Cheng, P. T., J. F. LaPeyre, J. T. Buchanan, T. R. Tiersch, and R. K. Cooper. Comparison of dissociation of oyster (*Crassostrea virginica*) tissues with several proteolytic enzymes. (17)

FRESHWATER ECOLOGY (*Rose Room*)

Technical Session V: Moderator - Steve Miranda, Mississippi State University.

- 10:00 *Bohannon, J. P., M. A. Konikoff, and J. V. Huner. Effects of substrate in simulated crawfish burrows on juvenile production and water chemistry. (17)
- 10:15 **Puzo, M. M. and L. E. Miranda. Diet overlap among inland silverside, yellow bass, bluegill, and largemouth bass in an oxbow of the Mississippi River. (18)
- 10:30 **Saxon, E. L. and C. M. Taylor. Spatial and temporal variation of fish assemblages within a highly disturbed drainage basin. (18)
- 10:45 **Williams, L. R., A. A. Echelle, and A. F. Echelle. Conservation of the leopard darter in Oklahoma and Arkansas: a population viability analysis and genetics approach. (19)
- 11:00 Taylor, C. M. and M. L. Warren. Colonization and extinction processes in Ouachita mountain stream fishes. (19)
- 11:10 Smiley, Jr., P. C., S. S. Knight, and C. M. Cooper. Watershed evaluation of the upper Yalobusha River: fishes. (20)
- 11:30 Peterson, M. S., L. C. Nicholson, D. J. Snyder, and G. L. Fulling. Status, age, reproduction, and diet of the undescribed southeastern bluesucker, *Cyprinus* sp. Cf *elongatus*. (20)

11:45 - 1:00 **Lunch**

AQUACULTURE/GENETICS (*Magnolia room*)

Technical Session VI: Moderator - Terry Tiersch, Louisiana State University

- 1:00 Lousteau, J. H. and R. K. Cooper. Conjugation and transformation efficiency of fish pathogen *Ewardsiella ictaluri* and *E.Coli* SM10 with suicide DNA Vector. (21)
- 1:15 Zhang, Q., R. K. Cooper, and T. R. Tiersch. In-situ polymerase chain reaction: a powerful tool for detection and localization of DNA sequences in fish genomes. (21)
- 1:30 Sawyer-Smith, B., R. K. Cooper, and T. R. Tiersch. Transfer of a heritable gene into Koi carp using lipofection. (22)
- 1:45 *Caffey, R. H. and T. R. Tiersch. An economic case study on the production of hybrid striped bass sperm with cryopreserved sperm. (22)
- 2:00 Segovia, M., J. A. Jenkins, C. Paniagua, T. R. Tiersch, and R. Reigh. Assessment of viability of tilapia sperm with dual DNA-staining and flow cytometry. (23)
- 2:15 Rodgers, S., R. Cooper, and C. Starliper. Homology of *Sul I* sequences among different bacterial species. (23)

(AQUACULTURE/GENETICS- *continued*)

2:30 *Lee, N. and T. R. Tiersch. Sterilization of the Malaysian prawn. (24)

COASTAL FISHERIES /HABITAT (*Rose room*)

Technical Session VII: Moderator - Mike Murphy, *Gulf Coast Community College*

1:00 **Bolden, J., D. Stanley, and C. Wilson. The fish community at an oil platform six months after an explosive event. (24)

1:15 Gitschlag, G. R. Impacts of explosive slavage of offshore oil and gas platforms on fisheries in the Gulf of Mexico. (25)

1:30 Romaine, T.L., M. Kasprzak, and J. Hanifen. Monitoring the impacts of environmental perturbations on commercial fishermen. (25)

1:45 Rester, J. K., A. G. Pulsipher, and D. V. Mesyanzhinov. Underwater obstruction in Louisiana's coastal waters and the Gulf of Mexico. (26)

2:00 Lukens, R. R. Revising the nation's artificial reef plan. (26)

2:15 Rester, J. K. The future implications of essential fish habitat. (27)

2:30 Donaldson, D. M. Southeast area monitoring and assessment program (seamap): state/fed. cooperative collecting program for the Southeast United States. (27)

2:45 STUDENT AWARDS AND RAFFLE

**Mississippi Chapter Student

*Louisiana Chapter Student

3:30 Meeting Adjourned

POSTER SESSION (*Rose room*)

(Authors presenting posters please be present during Thursday's Coffee breaks):

Fertl, D. and A. M. Landry, Jr. First report of a sharksucker (*Echeneis naucrates*) on a bottlenose dolphin (*Tursiops truncatus*), and a reevaluation of remora-cetacean associations. (28)

Harrel, S. L. and E. D. Dibble. Effects of water flow on foraging strategies of the bluntface shiner (*Cyprinella camura*). (29)

Jackson, D. and N. J. Brown-Peterson, Factors influencing stock structure of principal sport fishes in impoundments located on national forests in Mississippi. (30)

(POSTER SESSION- *continued*)

Killgore, K. J. Sampling fish in submersed aquatic plants. (31)

Knight, C. L., R. L. Jones, P. D. Hartfield, and T. C. Majure. Status of freshwater mussel populations in major tributaries of Tombigbee river system, Mississippi. (31)

Peterson, M. S., C. F. Rakocinski, and B. H. Comyns. Environmental variation and early growth of important estuarine fishes: development of an approach to assess environmental change. (32)

Sanders, L. and E. A. Theriot. Zebra mussel research program. (32)

ABSTRACTS

For papers presented at the joint Mississippi and Louisiana Chapter AFS Meeting, February 4-6, 1998, Casino Magic, Bay St. Louis, MS.

(Abstracts are in order of presentation)

STOCK ASSESSMENT OF SPOTTED SEATROUT (*CYNOSCION ARENARIUS*) IN MISSISSIPPI COASTAL WATERS. J. Warren, Gulf Coast Research Laboratory.

Spotted seatrout are probably the most highly sought sport fish in Mississippi's coastal waters. This population also supports a relatively small commercial harvest, currently operating under a 40,000 pounds per year quota. A perceived reduction of inshore stocks has caused concern about the abundance of the population and whether the stock can sustain itself under the current level of utilization. Fishery independent sampling from 1992-96 and fishery dependent data from the recreational and commercial catch from 1984-1996 have been used to assess the population parameters of age structure, length-at-age estimates and length-weight relationships. Age structures were used to estimate fishing mortalities using catch curve and virtual population analyses. A spawning stock biomass and spawning potential ratio (SPR) were estimated from these data. Current estimates of SPR are approximately 19% which is generally considered slightly below the lower threshold for many species. Because fish as young as one year of age were found to contribute to the spawn suggests that this population can sustain itself at the current level of exploitation even though the population is at a relative low SPR.

AGE VALIDATION OF RED DRUM, *SCIAENOPS OCELLATUS*, FROM THE GULF OF MEXICO USING ANALYSIS OF RADIUM-226 AND POLONIUM-210 IN OTOLITHS. Baker, Jr., M. Scott*, Charles A. Wilson, and Daniel Van Gent. Coastal Fisheries Institute, Louisiana State University, Baton Rouge, LA 70803-7503.

Fish ages are often estimated by counting growth zones (whole otolith technique) and/or cross sections (otolith section technique) in the largest of their otoliths, the sagittae. These growth zones, alternating opaque and translucent bands, can be validated as annual marks if both bands occur during each year of growth. Annuli in red drum otoliths have been successfully validated to 36 years by marginal increment analysis, tag and recapture, and tetracycline marking of otoliths and therefore provide a good control for the radiometric age validation technique. Because radiometric analysis of otoliths provides an independent approach to the age validation, errors involving reader interpretation are greatly reduced in the process. The Coastal Fisheries Institute has established the techniques to approach validation using analysis of radium-226 and polonium-210 as an indication of fish age. For the two age groups completed, 10 and 20 years, radiometric ages were determined to be between 5-10 years and 15-20 years. Initial results indicate that radon-222 emanation is not significant, and that the deviations found between radiometric age and otolith section age could be due to errors in the preparation process, improper spectrometer calibration, non annual mark formation in otoliths, or a combination of factors.

***Student Presentation (LA)**

AGE AND SIZE DISTRIBUTION OF COMMERCIALY HARVESTED RED SNAPPER (*LUTJANUS CAMPECHANUS*) IN THE NORTHERN GULF OF MEXICO. David L. Nieland and Charles A. Wilson. Coastal Fisheries Institute, CCEER, Louisiana State University, Baton Rouge, Louisiana 70803-7503.

Red snapper (N = 2,086) from the commercial fishery of the northern GOM were sampled from 1995 through 1997. Specimens ranged from 315 to 880 cm FL. Length frequency distributions for sexes combined varied significantly among all sample years. Marginal increment analysis validation curves for young (≤ 5 years), older (≥ 6 years), and all specimens combined indicated that a single opaque annulus is formed from about November to June. Red snapper age ranged from 1 to 48 years. Age frequency distributions also varied significantly among the three years. Few individuals sampled during 1996 and 1997 were greater than 8 years of age. If our samples are representative of each year's harvest, the fishery apparently moved into harvesting smaller, younger red snapper over the duration of the project. Age-growth relationships modeled with von Bertalanffy growth equations for the separate sexes accounted for significantly more variability than modeling the sexes combined; thus significant differences in growth between the sexes is implied.

A COMPARISON OF BLUE CRAB CATCH IN CRAB TRAPS FITTED WITH DIAMONDBACK EXCLUDER DEVICE VS. CRAB TRAPS WITHOUT. Kerwin Jude Cuevas, Michael V. Buchanan, William S. Perret, and James Warren. Mississippi Department of Marine Resources.

From April through August 1997 in Mississippi Sound waters, comparisons were made on the catch rate and sizes of blue crabs (*Callinectes sapidus*) equipped with and without a diamondback terrapin (*Malaclemys terrapin*) excluder device. The excluder device consists of welding rods shaped into a 5 X 10 cm rectangle fitted into the funnel entrances of the crab traps. All blue crabs taken were counted, measured in millimeters (carapace width), sexed and any bycatch was recorded. A total of 740 blue crabs were captured, 370 in control traps and 370 in excluder traps. The data collected showed no statistical difference in the mean size (two tailed t-test) and catch rate (paired t-test) by trap type. However, the Kolmogorov-Smirnov Two Sample Test indicated a statistically significant difference in the size distribution of blue crabs between the two trap types. This statistical difference is attributed to the small sample size of blue crabs collected. The bycatch did not include any diamondback terrapins. Little difference in catch rate of bycatch was seen between the two trap types.

PROFILE OF SHARKS ASSOCIATED WITH THE U.S. GULF MENHADEN FISHERY AND THEIR RELEVANCE TO SHARK POPULATIONS IN THE ATLANTIC OCEAN AND GULF OF MEXICO. Janaka de Silva* and Richard Condrey. Department of Oceanography and Coastal Sciences, Coastal Fisheries Institute, Louisiana State University, Baton Rouge, Louisiana 70803-7503.

We describe abundance, composition, fate, and distribution of the shark bycatch in the gulf menhaden fishery. For 1994 and 1995 we estimate an annual take of 36,000 and 33,000 sharks. Using loglinea and logit models we determined spatial and temporal patterns in the shark bycatch. Contrasts revealed the odds of observing a set with shark bycatch was significantly greater in June-August than during September-October. The odds of observing shark bycatch during April-May was significantly different from September-October. However, these differences were only apparent east of 93° W. Black tip sharks were the most abundant of the 10 shark species encountered. Approximately 75% of the sharks died, 20% were released disoriented or healthy. Stomach analyses indicated that the sharks were preying on menhaden while length information indicated that the majority of the sharks were juveniles. Comparison of our results with previous studies indicates that, while the rates of shark bycatch in the fishery have remained similar since 1948, a possible shift in the species composition of sharks encountered may have occurred. Results are discussed in light of the current Secretarial Shark Plan.

***Student Presentation (LA)**

PRELIMINARY EXAMINATION OF AGE AND REPRODUCTION OF WAHOO, *ACANTHOCYBIUM SOLANDRI*, FROM THE NORTHCENTRAL GULF OF MEXICO. James S. Franks and Nancy Brown-Peterson. University of Southern Mississippi, Institute of Marine Sciences, Gulf Coast Research Laboratory, Ocean Springs, MS.

A small sample of wahoo, *Acanthocybium solandri*, caught during the summer (June-September) of 1997 in the northcentral Gulf of Mexico offshore recreational fishery was examined to: 1) evaluate the potential of sagittal otoliths and the first dorsal fin spine for age estimation; and 2) preliminarily assess reproductive status. Observations of whole sagittae revealed faint bands (annuli?) in the posterior region and a series of small, external ridges along the length of the antirostrum which Scanning Electron Microscopy (SEM) observations suggested might represent daily markings. Transverse thin-sections of sagittae typically revealed ambiguous markings, however, thin-sections of the first dorsal spine generally showed a reasonably well-defined core surrounded by a succession of legible bands. Preliminary histological assessment of a few ovaries collected throughout the summer showed a variety of development stages. Small females (89.6 and 100.5 mm FL) collected in June were assessed as early-developing and immature, respectively. Late developing/ripe ovaries were observed from June through August, and the ovaries of two fish (165.8 and 166.0 mm FL) collected in June contained hydrated oocytes. Wahoo were determined to be multiple (batch) spawners. The ovaries of a 148.5 mm FL specimen caught in September appeared spent. Testes from males (106.0-142.0 mm FL) collected throughout the summer were ripe.

A SYNCHRONOUS HERMAPHRODITIC STRIPED MULLET: TO BE MALE OR FEMALE Nancy J. Brown-Peterson and James S. Franks, USM Institute of Marine Sciences, Gulf Coast Research Laboratory

A synchronous hermaphroditic striped mullet, *Mugil cephalus*, was captured offshore of Southwest Pass, Louisiana on December 6, 1996 during the commercial roe mullet fishery harvest. The fish measured 412 mm FL, weighed 824 g and was determined to be 4 years old by otolith analysis. Gross examination of the gonads revealed four lobes: right and left ovaries and right and left testis which represents a unique occurrence among hermaphroditic fish. All lobes ended in a common sperm duct/oviduct with the exception of the left ovary which had no oviduct. Both ovaries contained vitellogenic oocytes and both testis had freely running spermatozoa. Histological examination showed many oocytes undergoing final oocyte maturation, the presence of some post ovulatory follicles and lobules full of tailed spermatozoa. There was no evidence of the intermingling of sperm and oocytes within the gonad. The capture of this fish on the spawning grounds and the advanced stage of both ovarian and testicular development suggests spawning probably would involve the release of both oocytes and spermatozoa.

HABITAT AND COASTAL MARINE FISHERIES: A REVIEW OF THE CONNECTIONS. Stephen T. Ross, and Pamela J. Schofield, Department of Biological Sciences, University of Southern Mississippi.

Habitat forms a template upon which the biological processes of organisms, populations, and communities occur. Because human population densities are particularly concentrated and are growing most rapidly near coastal areas, a tension is formed between biological productivity of the sea and human population growth. Our goal is to examine how scientists are addressing the links between habitats and marine fisheries. We have focused on species of fisheries importance along the Gulf of Mexico and western North Atlantic Ocean in coastal marine and estuarine areas. Our database has been built from primary research papers published over the last five years in: Bull. Mar. Sci., Estuaries, Fish. Bull., and Trans. Amer. Fish. Soc. We examined 94 journal issues containing 1715 major articles, of which 347 (20%) dealt with fish-habitat relationships and 105 (6%) dealt with southeastern, marine fish-habitat relationships. Geographically, the greatest density of studies is along the NE Atlantic coast, followed by studies along the W Florida coast. Fewer studies addressed egg (5%) or larval stages (33%), while 58% and 50%, respectively, addressed juvenile and adult stages. The preliminary results point to a need for caution in generalizing about habitat variation or modification across different habitats or taxonomic groups.

ISSUES AND TRENDS IN ESTUARINE AND COASTAL FISHERIES AND FISH HABITATS IN LOUISIANA. Edward Chesney¹, Glenn Thomas², and Donald Baltz³.

¹Louisiana Universities Marine Consortium, ²Marine Fisheries Division, Louisiana Department of Wildlife & Fisheries (Presenting), ³Coastal Fisheries Institute, CCEER & Dept. Oceanography and Coastal Sciences, Louisiana State University

Stimulated by nutrients from the Mississippi river, the vast coastal wetlands of the river's past and present deltas interface with the Gulf of Mexico to form a complex and prolific marine ecosystem that yields significant landings of fish and shellfish to the region: annual landings have exceeded one billion pounds since 1969. This productive system for fisheries resources has been exploited and significantly altered over the years to meet the demands for coastal development, seafood, navigation, oil exploration, flood control and other social, economic, and industrial activities. While not all changes to fishery habitats can be viewed as negative, some of these changes have contributed to significant ecological problems such as saltwater intrusion, loss of coastal wetlands, and regions of marine hypoxia. Management strategies to deal with some of these problems propose directed manipulations of the coastal environments to stop or reduce rates of degradation. Although data are lacking to look at more than a few decades of environmental changes, a look at trends in selected species of living resources over the past twenty years suggests that in many cases they have been remarkably resilient to significant changes in their habitats. We examined some of the major changes in the habitat and discuss some of the proposed and implemented management strategies aimed at minimizing further degradation of this important marine ecosystem.

AN EVALUATION OF A CONSTRUCTED MARSH AS SUITABLE HABITAT FOR INTERTIDAL NEKTON. Mark W. LaSalle, Mississippi State University, Coastal Research and Extension Center, Biloxi, MS.

Detailed assessments of the major biotic components of a 25-acre constructed intertidal marsh were undertaken 7 years after it was constructed by grading down of uplands. The use of low (*Spartina alterniflora*) and mid-elevation (*Juncus roemerianus*) marsh zones by nekton within the constructed site and a nearby natural marsh were compared using 100-m² flume weirs. The effect of a constructed tidal creek on nekton usage in the constructed site was assessed using 6 m² lift nets. Overall, assemblages of nekton were similar between the constructed and natural marshes, composed of a similar suite of year-round resident fish and shellfish (e.g., killifishes, and grass shrimp) and the seasonally occurring juveniles of estuarine transient species (e.g., spot, brown and white shrimp). A lower than normal elevation in the constructed low marsh zone resulted in higher densities of transient species, due to greater flooding duration. The constructed tidal creek appeared to allow access to the entire marsh area by both resident and transient species. Overall, the constructed marsh studied appeared to serve as adequate habitat for intertidal nekton.

HOW HABITAT SPECIFIC IS FEEDING AMONG ANIMALS THAT UTILIZE THE MARSH EDGE? John W. Fleeger. Department of Biological Sciences, Louisiana State University, Baton Rouge, LA 70803.

The marsh edge in estuaries maintains exceptionally high abundances of fish and invertebrates, but the underlying cause of this pattern is poorly understood. Increased food resources and predator refuge associated with *Spartina alterniflora* stems are the most common explanations. Studies of feeding intensity and success in and around the marsh edge has been slow to be performed. Here, I report research on the feeding biology of two species common in estuaries; grass shrimp, *Palaemonetes pugio* and bay whiff, *Citharichthys spilopterus*. Gut-content analysis of bay whiff was used with exploratory regression models to identify the influence of marsh-edge characteristics on feeding success. Variables associated with topography, water movement and physiological function (i.e., temperature, salinity, dissolved oxygen) were used; factors that influenced physiological function contributed to the regression models while those associated with the marsh edge (i.e., presence of grass stems) did not. Alternatively, grass shrimp (studied with field manipulations and ¹⁴C labeling) were most capable feeding on the meiofauna and epiphytic algae of grass stems. Grass shrimp were ineffective consumers of meiofauna and microalgae from unvegetated sediments and planktonic sources. Habitat specificity in feeding appears to be common among animals that utilize the marsh edge.

THE IMPORTANCE OF ESTUARINE SUBMERGED AQUATIC VEGETATION AS A FEEDING HABITAT FOR BLUEGILL, REDEAR, AND REDSPOTTED SUNFISH. Kathy E. VanderKooy*, Chet F. Rakocinski, and Richard W. Heard. The University of Southern Mississippi, Institute of Marine Science, Gulf Coast Research Laboratory.

By studying trophic relationships among three co-occurring sunfishes, we can gain a better understanding of their associations in estuarine submerged vegetation. *Lepomis miniatus* (redspotted sunfish), *L. microlophus* (redeer sunfish), and *L. macrochirus* (bluegill) were collected from an oligo-mesohaline bayou in Ocean Springs, Mississippi. Fish and prey availability samples were taken from March 1994 - January 1995. A total of 609 stomachs were examined from fishes representing three size classes. Based on diet composition, some degree of spatial segregation in feeding habitat occurred among the species. However, a high degree of trophic overlap existed among small size classes of all three species. Submerged aquatic vegetation (SAV) was an important feeding habitat for all sunfishes, and also provided an important refuge area for juvenile sunfishes. But trophic overlap among species was reduced by the use of forage areas other than SAV. Diet composition and use of feeding habitats changed seasonally. During spring and summer, fishes utilized SAV and sediment for feeding habitats. However, during autumn, all fishes increased their use of SAV for feeding. This increased use of SAV habitat for feeding coincided with declining SAV coverage, suggesting that competition during autumn was greater than in other seasons.

***Student Presentation(MS)**

TREATMENT OF COONTAIL (*CERATOPHYLLUM DEMERSUM*) AT BOLIVAR COUNTY STATE FISHING LAKE. Dennis Riecke, Garry Lucas, and Jimmie Russell. Mississippi Department of Wildlife, Fisheries & Parks, Jackson, MS.

Our talk is a chronology of the activities we performed at a newly renovated, agency-owned lake which developed a severe infestation of coontail (*Ceratophyllum demersum*). Lake history, fertilization, aquatic plant control and grass carp stockings will be discussed. Our objective was to achieve total control of coontail prior to the reopening date. Good control was observed with spot treatments of the contact herbicide, Aquathol K at a 4.0 ppm concentration (10.5 gal/acre; 432.00/acre). Sonar AS, a systemic herbicide, was applied at a rate of 1 quart/acre (75 ppb Fluridone) in the infested area (about 33% of the total surface area) about 75 days prior to the reopening date. Coontail was totally eradicated from the lake within 60 days post treatment. Assays of lake water detected mean concentrations of Fluridone of 21.5, 10.3, and 8.3 ppb at 18, 32, and 49 days after Sonar AS application, respectively. On a total surface area basis, coontail was effectively controlled with Sonar AS at 0.33 quarts/acre (25 ppb Fluridone) at a cost of 98.00/acre.

DIET OF PADDLEFISH (*POLYODON SPATHULA*) IN A MISSISSIPPI DELTA STREAM. Steven G. George, Jan Jeffrey Hoover, and K. Jack Killgore. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Throughout their geographic range, paddlefish feed intensively and indiscriminately on large zooplankton, but in small, turbid streams of the south, diets are undocumented. We examined stomach contents of 96 fish, 411-862 mm eye-to-fork length, from the Big Sunflower River of which 82 contained substantial quantities of food. Total number of prey in each stomach ranged from 1.1 10^3 to 4.1 10^6 but means (6.3×10^4 /stomach to 1.2×10^5 /stomach) were not significantly different among size classes of fish ($p = 0.42$, d.f. = 2/80). Diet was numerically dominated by four groups of organisms: water fleas (Daphnidae, Bosminidae, Chydoridae), 49.3%; copepods (Calanoidae, Cyclopoida), 47.3%; seed shrimp (Ostracoda), 2.1%; and insects (Diptera, Coleoptera, and others), 1.3%. Diet composition, however, varied with total number of prey eaten and among river reaches. Seed shrimp and insects were eaten in disproportionately lower numbers by fish with greater quantities of food in their stomach ($r < -0.20$, $p < 0.07$). Copepods comprised greater percentages of paddlefish diets in a lower reach downstream from the mouth of a large stream (48.4-53.2%) than from an upper reach with no major tributaries (22.0-43.2%). Food habits of paddlefish in the Big Sunflower River are similar to those elsewhere; variation between populations and among individuals are probably due to differences in food availability or hydrologic conditions at time of collection.

IMPACT OF CORMORANTS ON THE CRAPPIE POPULATION OF LAKE BEULAH. Charles E. Vyles, Resource Biologist - MDWFP, Garry Lucas, Fisheries Biologist - MDWFP, James Glahn - USDA-ADC, Charles (Bo) Sloan - USDA-ADC, Jobe Maynor - USDA-ADC.

The Mississippi Department of Wildlife, Fisheries & Parks (MDWFP) received complaints from anglers of poor fishing on Lake Beulah during the winter of 1994-1995. These fishermen reported tremendous numbers of Double-crested Cormorants (*Phalacrocrax auritus*) on Lake Beulah and were concerned that cormorants were the reason for their poor fishing success. This project was undertaken to determine if double crested cormorants were capable of exerting significant predatory pressure on the gamefish, principally crappie, of Lake Beulah. Project results show that the Double Crested Cormorants are opportunistic feeders preying on fish that are easiest to catch. Stomach analysis from two years of sampling indicated that shad is the dominate forage type comprising 92% of stomachs contents. The data indicates that cormorants are not impacting the crappie population of Beulah Lake.

LEGAL CONSIDERATIONS FOR FISHERIES MANAGEMENT. Frederick C. Whitrock, Assistant Attorney General, La. Department of Justice.

Attempts by states to manage fisheries resources, particularly methods which restrict previously legal gear and/or restrict access into a fishery, result, in many cases, in legal challenges by the affected fishermen. These challenges usually include claims that the methods chosen violate several of the fisherman's constitutional rights, including their right to due process and equal protection under the law, result in a taking of their property without just compensation, unconstitutionally interfere with interstate commerce, and are preempted by federal law. This presentation will give an overview of these constitutional provisions, how they relate to fisheries regulation, and how these issues have been decided by the courts.

THE USE OF REAL-TIME HYDROGRAPHIC MONITORING DATA IN FISHERIES MANAGEMENT. M. Michelle Kasprzak¹ and George Arcement². ¹Louisiana Department of Wildlife and Fisheries, ²U. S. Geological Survey.

Louisiana Department of Wildlife and Fisheries (LDWF) has maintained a network on continuous recording instruments to monitor water conductance, salinity, temperature and level since 1958. Early technology required retrieval of data from the field and subsequent post-processing time which could range from one day to several weeks, depending on the recording media. Although the data could be used in retrospect to analyze the effects of hydrographic processes on fisheries, managers could not utilize the data in day to day management decisions. At best the data available to manager was one to six months old. In 1995, LDWF entered into a cooperative agreement with the U. S. Geological Survey to upgrade the existing LDWF constant recorder network to real-time capability. Data are transmitted in real-time (4 hour satellite delay) via GOES satellite to the USGS computer. These real-time data are available to Department personnel via the USGS ADAPS system and water level is currently available to the public via Internet access. The real-time data have been utilized by LDWF fisheries managers to monitor hydrographic conditions that affect finfish, oyster and shrimp populations. Expansion of the real-time hydrographic data collection network is underway with the planned addition of an offshore monitoring platform located in conjunction with the LDWF Freeport Artificial Reef site.

RATIONALE FOR REMOVAL OF MINIMUM LENGTH LIMITS FROM DELTA LAKES. Garry Lucas, Fisheries Biologist, Mississippi Department of Wildlife, Fisheries & Parks, District 3, Merigold, MS 38759.

The populations of largemouth bass in most of the lakes within the interior of the Mississippi Delta are at low levels. Well below levels desirable for management. Minimum length limits have been used for the past ten years as a harvest restriction to assist in the improvement of the bass population in several Delta Lakes. The reason for the low number of bass was not due to over-harvest, but is believed due to environmental conditions that limit spawning success and survival of the bass. The length limits were imposed to allow the bass to spawn about twice, prior to their exposure to harvest and to optimize harvest of larger than normal year classes of bass produced in years with favorable environmental conditions. In some lakes there has been no accumulation of bass below minimum length. It would seem unfair to penalize a person for having an undersized bass when there appears that little benefit is generated by the restriction.

The bass population is still depressed in most of the interior lakes of the Delta. The statewide black bass creel is not appropriate for these lakes. A length limit restriction has the potential to be an effective tool in the management of bass populations, but it appears that a certain size population is necessary for a length limit to be effective. The harvest restriction of a creel limit of two black bass has some advantages versus the use of a length limit to restrict harvest. A reduced creel limit is easier to enforce, less confusing to the angler, can be effective in limiting harvest, and is not as restrictive on the angler while meeting management needs. There is some concern that the minimum length limit may have reduced fishing activity. The general public may be avoiding lakes with length limits for fear of violating the length limit from inability to measure captured fish. The two fish creel limit will coincide with increased law enforcement surveillance on Delta lakes.

CHARACTERISTICS AND ATTITUDES OF LOUISIANA FRESHWATER ANGLERS.

Herb Holloway, David Lavergne, and Brian McManus. Socioeconomic Research and Development Section, Louisiana Department of Wildlife and Fisheries.

Freshwater recreational fishing is a popular activity for many Louisiana residents, and an important contributor to the economy of the state. In order to assess the characteristics, values, and attitudes of Louisiana freshwater anglers, data collected from the Survey of Louisiana Recreational Anglers--1990 (Kelso et al., 1991) and from the Survey of Louisiana Recreational Anglers--1991 (Kelso et al., 1992) were analyzed based on the respondents' indicated primary target species. Socioeconomic characteristics such as age, sex, race, education, income, and parish of residence were analyzed, along with the respondents' values and attitudes toward fishing, fishing effort, favorite fishing locations, opinions on fishery management alternatives, and estimated expenditures on fishing. The socioeconomic characteristics were found to influence the respondents' choice of target species, and the various target species groups displayed some differences in attitudes, effort, opinions, and expenditures. Although there were also many similarities across all of the target species groups, the responses of bass anglers often differentiated them from the other groups, at least in degree.

PADDLEFISH, STURGEON AND CITES IN LOUISIANA. Bobby C. Reed. Louisiana Department of wildlife and Fisheries, Inland Fisheries Division, District V, Lake Charles, LA.

Effective April 1, 1998, all sturgeon and paddlefish species worldwide will be covered under CITES [Convention on International Trade in Endangered Species of Wild Fauna and Flora]. To insure that commercial demand does not threaten their survival in the wild, paddlefish and sturgeon will be protected by CITES, a treaty that regulates trade in listed species, including hybrids and captive-bred specimens, through a system of permits. Under CITES, a listed species is afforded protection in one of three levels (Appendix I, II or III). Paddlefish and sturgeon belong to the order Acipenseriformes, a ancient group of approximately 27 species of fish, which are widely distributed in the northern hemisphere. This group exhibits certain biological attributes which make them vulnerable to intensive fishing pressure as subadults and adults. Although females produce moderate quantities of eggs, juvenile mortality is high; sturgeons are generally long-lived and slow to mature (reaching sexual maturity in 6 - 25 years); and depend on large rivers to spawn. Paddlefish and sturgeon are fished for meat and caviar, with caviar being the most valuable product and in highest demand in international trade - legally and illegally! Louisiana has four species that will be affected under the CITES listing: the American Paddlefish (*Polyodon spathula*), the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), the pallid sturgeon (*Scaphirhynchus albus*) and the shovelnose sturgeon (*Scaphirhynchus platorynchus*). The paddlefish has been afforded complete protection in Louisiana since 1986 and was listed in Appendix II of CITES in 1992. All three species of sturgeon became state protected by in 1990, and subsequently, the pallid sturgeon was listed as federally endangered in 1990 and the Gulf sturgeon as federally threatened in 1993. All three species of sturgeon are listed in Appendix II under CITES.

**DEVELOPMENT OF METHODS FOR A STURGEON GERMPLASM REPOSITORY:
BLOOD COLLECTION. William R. Wayman* and Terrence R. Tiersch. School of Forestry,
Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University
Agricultural Center.**

North American sturgeon populations are declining due to overfishing, habitat loss and hybridization. As part of an ongoing study on the development of a cryopreserved sperm repository for North American sturgeon species, we investigated methods for the collection and handling of blood samples for analysis by flow cytometry. This could allow verification of samples critical for the establishment and maintenance of a repository. Blood was collected from pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon (*Scaphirhynchus platorynchus*). Deoxyribonucleic acid (DNA) content of red blood cells stained with propidium iodide was analyzed by flow cytometry. There were no differences ($P = 0.9963$) in the DNA content of pallid sturgeon (3.976 pg), shovelnose sturgeon (3.975 pg) or putative hybrids (3.976 pg). Shovelnose sturgeon blood could be refrigerated (1°C) for 2 days before values for DNA content were significantly different ($P = 0.0001$) from initial values. Blood collected from pallid sturgeon and shovelnose sturgeon and stored with different volumes of anticoagulant (10, 25, and 50% of ACD solution) did not reveal different ($P = 0.1566$) DNA content values. DNA values for blood stored on the bench top (23 °C) for 48 hrs were different ($P = 0.0108$) from blood stored in the refrigerator. Pallid sturgeon and shovelnose sturgeon could not be distinguished by flow cytometry, although this technique has revealed an average of 4.7% among other sturgeon species.

***Student Presentation (LA)**

RELATIVE ABUNDANCE AND HABITAT UTILIZATION OF PALLID AND SHOVELNOSE STURGEONS IN THE LOWER MISSISSIPPI RIVER. K. Jack Killgore¹, Jan J. Hoover¹, Steven G. George¹, and William Lancaster². ¹U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, ²153 Landfill Rd., Sunflower, MS.

Pallid (*Scaphirhynchus albus*) and shovelnose (*Scaphirhynchus platorynchus*) sturgeons are sympatric throughout the Mississippi River System. The federally endangered pallid sturgeon, however, is rare when compared with the common shovelnose sturgeon, but estimates of its relative abundance vary substantially. We have been evaluating abundance and habitat use of these two species in the lower Mississippi River near the mouth of the Arkansas River. Trot lines have been used during winters of 1995, 1996, and 1997 to obtain > 320 shovelnose sturgeon and 16 pallid (or hybrid) sturgeon. Sturgeon are measured and weighed, and morphometric data recorded. Prior to release, sturgeon are marked with Peterson disc and passive integrated transponder (PIT) tags. Depth and distances from shore are recorded. In 1997, 123 shovelnose and 4 pallid sturgeon were collected. Shallow (< 5 m), nearshore (< 35 m) habitats were not sampled. Three of the four pallid sturgeon were collected 85 - 150 m from shore in depths of approximately 12 m. Shovelnose sturgeon were collected 60 - 150 m from shore in depths of 8-15 m. Our data support previous studies indicating that << 20% of Mississippi River sturgeons are pallid sturgeon and that pallid sturgeon occupy a narrower range of habitats than do shovelnose sturgeon.

MORPHOMERISTIC VARIATION IN SHOVELNOSE STURGEON (*SCAPHIRHYNCHUS PLATORYNCHUS*) AND PALLID STURGEON (*S. ALBUS*) FROM THE LOWER MISSISSIPPI RIVER. Jan Jeffrey Hoover, Steven G. George, and K. Jack Killgore. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Monitoring populations of the shovelnose sturgeon and the rare and endangered pallid sturgeon necessitates rapid, reliable identifications in the field, but inter- and intra-specific variation in diagnostic characters are not well-documented for sympatric populations. We collected data from shovelnose (N = 25) and pallid sturgeon (N = 17) near Rosedale, MS and used principal component analysis (PCA) to analyze 11 meristic and 55 morphometric variables. Shovelnose sturgeon typically had fewer fin rays, fewer lateral plates, and more dorsal plates than pallid sturgeon, but ranges of values were not discrete, and minor overlap in multivariate meristic space occurred. Shovelnose sturgeon typically had larger lateral plates, longer peduncles, and scalier bellies, than pallid sturgeon, but ranges were similar and substantial overlap in multivariate morphometric space occurred. Shovelnose sturgeon are believed to have larger eyes and shorter snouts than pallid sturgeon, but significant differences did not exist in our data. Barbel ratio (outer/inner barbel length) varied with size of fish and was unreliable in distinguishing between the two species. In shovelnose sturgeon, several characters (outer barbel length, eye size, size of lateral plate, peduncle length) varied allometrically, making large specimens morphometrically similar to pallid sturgeon. Taxonomic keys or indices incorporating morphometric characters but failing to address ontogenetic changes in morphology could result in misidentification of sturgeon.

AGE, GROWTH, AND MORTALITY OF SHOVELNOSE STURGEON IN THE LOWER MISSISSIPPI RIVER James V. Morrow, Jr.*, James P. Kirk, and K. Jack Killgore, U. S. Army Corps of Engineers, Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, Mississippi 39180, USA

Two hundred of 295 shovelnose sturgeon *Scaphirhynchus platorynchus* captured in the Mississippi River near Rosedale and Vicksburg, Mississippi, were aged by examining sectioned pectoral fin rays. Age ranged from 2 to 16 years and the annual mortality rate was 20% for ages 7 through 16. The weight (g) to fork length (FL) (mm) relation was: $W = 0.000001262 FL^{3.174}$ ($R^2 = 0.87$). The von Bertalanffy growth equation for fork length was $FL = 738(1 - e^{-0.195(t+1.242)})$, and for weight was $W = 1,605(1 - e^{-0.148(t - 1.843)})$. Mortality and mean length at age were less than has been reported for upper Mississippi River populations of shovelnose sturgeon. Knowledge of causes of increased mortality of older shovelnose sturgeon may have applications in management of the sympatric pallid sturgeon *Scaphirhynchus albus*.

***Student Presentation (MS)**

SWIMMING ENDURANCE OF JUVENILE PALLID STURGEON (*SCAPHIRHYNCHUS ALBUS*). S. Reid Adams*, Jan Jeffrey Hoover, and K. Jack Killgore. U.S. Army Engineer Waterways Experiment Station ER-A, 3909 Halls Ferry Rd., Vicksburg, MS 39180.

Juvenile pallid sturgeon (*Scaphirhynchus albus*) from Gavins Point National Fish Hatchery in South Dakota, 13.0 - 20.0 cm fork length, were subjected to swimming stamina tests in a 100-L Blazka-type swim tunnel at 17 - 20°C. A fixed velocity protocol was applied in which fish swam a predetermined speed and the time recorded. Sturgeon were tested at speeds ranging from 10 - 70 cm s⁻¹ to measure burst, prolonged, and sustained swimming speeds; these are speeds maintained for < 20 seconds, 20 - 200 minutes, and > 200 min, respectively. Burst swimming speeds are the highest speeds attained by fish and are used in prey capture, predator avoidance, and short-term negotiation of fast currents. In our experiments, sturgeon swam burst speeds of 55 - 70 cm s⁻¹; higher speeds may be attainable, but we reached the maximum capacity of the swimming flume. Prolonged swimming speeds of pallid sturgeon ranged from 30 - 50 cm s⁻¹ and swimming ended in fatigue, representing the depletion of aerobic fuels. Long-term or sustained swimming does not end in fatigue and includes migrating speeds as well as routine activity (foraging and station holding). Pallid sturgeon were able to swim up to 480 minutes at speeds less than 30 cm s⁻¹. Sustained and prolonged speeds of juvenile pallid sturgeon are comparable to speeds reported for similar sized lake sturgeon (*Acipenser fulvescens*); however, pallid sturgeon demonstrated a higher capacity for burst swimming.

***Student Presentation (MS)**

STATUS AND FUTURE OF THE PEARL RIVER GULF STURGEON POPULATION.

James P. Kirk¹, K. Jack Killgore¹, James V. Morrow, Jr.¹, Charles Knight², and Howard E. Rogillio³. ¹ U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS, ² Mississippi Museum of Natural Science, Jackson, MS, and ³ Louisiana Department of Wildlife and Fisheries, LaCombe, LA.

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) population in the Pearl River was monitored from 1992 through 1996 and compared to historical data sets from the 1960's and 1980's. The estimated population size in 1996 was approximately 300 fish with adults comprising about 3% of the population. Annual mortality rates in the late 1960's were about 9%; these rates increased to almost 40% in 1985 and decreased to about 26% during 1992 through 1996. Population modeling using numbers, age structure, mortality estimates, and a variety of recruitment functions was used to determine trends and status of Gulf sturgeon populations. Results of our models imply that this population can only withstand annual mortality rates in the range of 13 to 18%, depending upon recruitment assumptions. Hence, the future status of this population should be considered uncertain. Modeling further suggests that catch and effort data specified in the Gulf Sturgeon Recovery Plan may not detect a declining population. Recovery goals can be set using mortality, growth, and recruitment simulated in the model and a recovery trajectory based upon population size and size structure described. Consequently, the Recovery Plan's long term objective of recruitment equaling mortality over a twelve year period and constant CPUE should be changed to doubling the population size with adults comprising 8 to 25% of the population (based upon recruitment assumptions) over the 27- year recovery period.

EFFECTS OF SUPPLEMENTAL FEEDING AND ROTATIONAL TRAPPING ON YIELD AND SIZE OF CRAWFISH IN PONDS. Robert P. Romaine, Karim Belhadjali, and Robert C. Reigh. School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803 USA

The effects of three trapping and feeding strategies on crawfish yield, harvest size, and profitability were evaluated in six, 2-2.5 ha earthen ponds, planted with rice as forage for crawfish. Two ponds were assigned to each treatment. In the conventional trapping treatment (control), crawfish did not receive supplemental feed and were trapped 3 days per week (2,442 trap-sets/ha/season) from February through May. In the rotational trapping treatment, crawfish did not receive supplemental feed and were harvested in one-half of the pond for 2 weeks after which trapping was rotated to the other half for 2 weeks and the process was repeated (1,445 trap-sets/ha/season). Crawfish in the rotational-fed treatment were harvested by rotational trapping and a formulated crawfish feed (25% crude protein) was added to “non-trapped” areas of the pond.

Supplemental feeding of crawfish interfered with attractability of baited traps. Yield obtained with conventional trapping (1,832 kg/ha) was 24% and 89% higher, respectively, than rotational trapping (1,474 kg/ha) and rotational-fed trapping (970 kg/ha). Catch per unit effort with rotational trapping (1.02 kg/trap-set/day) was 36-48% higher than conventional (0.75 kg/trap) and rotational-fed (0.69 kg/trap) trapping treatments. Larger crawfish were harvested in the rotational-fed (26.4 g) and rotational trapping (25.5 g) treatments than in the conventional treatment, with 51 to 57% of crawfish harvested exceeding 23 g. Mean size with conventional trapping was 21.0 g with only 32% exceeding 23 g. Highest profit was obtained with conventional or rotational trapping. The low yield and high cost of feed significantly reduced profit in the rotational-fed treatment.

PERFORMANCE OF CRYOPRESERVED OYSTER SPERM AND EMBRYOS IN THE HATCHERY. Carmen G. Paniagua-Chavez¹, John E. Supan², John Buchanan², Terrence R. Tiersch¹. ¹School of Forestry, Wildlife and Fisheries; Louisiana State University Agricultural Center; Louisiana Agricultural Experiment Station; Baton Rouge, Louisiana 70803; ²Department of Oceanography and Coastal Science; Louisiana State University; Baton Rouge, Louisiana 70803.

Previous reports on fertilizing ability of thawed sperm, and viability of thawed embryos have been limited to 24 h in laboratory settings. For aquacultural purposes, the performance of gametes and embryos in the hatchery is of primary importance. Sperm were diluted in HBSS (without calcium) containing 15% propylene glycol, or 0.25M sucrose. Twenty 5-mL straws were filled, frozen in a controller freezer computer, and stored at -196 °C. A total of 3×10^6 trochophore embryos were placed in 60 5-mL straws and frozen. The frozen material was transported to Grand Isle, Louisiana. Three 200-L tanks were used for the experiment: The first was used as a control. The second was used to incubate eggs fertilized with thawed sperm, and the third to incubate thawed embryos. After 24 h, 1.7×10^5 D-stage larvae were obtained from the control tank, 1.5×10^5 from the second, and 400,000 from the third. After 10 d, the larvae were placed to set in a cultch system. Spats were placed in plastic bags and suspended in the ocean to evaluate survival and growth. The results indicate that oyster produced from cryopreserved sperm and embryos develop normally at hatchery level opening a great opportunity for the oyster industry.

NATURALLY OCCURRING BANDING IN OYSTER CHROMOSOMES.

Gang Yu, Quiyang Zhang, Carmen Paniagua, and Terrence Tiersch

**School of Forestry, Wildlife and Fisheries, Louisiana Agricultural Experiment Station,
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The identification of individual chromosomes is essential for genome mapping. This allows location of genes to specific sites on chromosomes. A problem in aquatic species is the large numbers of chromosomes (often more than 60). The American oyster (*Crassostrea virginica*) has 20 chromosomes in diploid tissues, and only 10 in gametes. This species is commercially important in Louisiana, and thus provides opportunities for basic and applied research. The objectives of this study were to prepare chromosomes from gonad tissue, to analyze them with computer-aided image analysis, and to prepare standardized karyotypes. Gonad tissues were removed from mature oysters and soaked in 0.9% sodium citrate for 6 to 12 hours. The tissue fragments were fixed once in Carnoy's fixative and twice in a mixture (3:1) of methanol and acetic acid. Chromosomes spreads were prepared by standard air-drying methods, and Giemsa staining was used for image analysis and karyotyping. Spreads with 10 or 20 chromosomes were observed. Naturally occurring bands were found in stained chromosomes, without the need for application of additional techniques. These bands allowed identification of chromosomes when used in combination with measurement of relative length. Chromosomes obtained in this way can be used for genome mapping techniques such as fluorescent in-situ hybridization, although some technical problems remain, such as the overlapping of elongated chromosomes.

EFFECTS OF PROTEASE INHIBITORS ON THE OYSTER PATHOGEN *PERKINSUS MARINUS* IN VITRO. Helen S. Kristensen*, Jerome F. La Peyre and Richard K. Cooper.
Department of Veterinary Science, Louisiana State University, Baton Rouge, LA, 70803.

Perkinsus marinus is a protozoan that causes severe mortalities in oysters (*Crassostrea virginica*) along the Atlantic and Gulf coasts. This pathogen secretes potent serine proteases which are believed to play an important role in pathogenesis. Blocking of parasite proteases by synthetic or naturally occurring protease inhibitors can significantly reduce the ability of parasites to invade host tissues and cells, inhibit their growth and interfere with their development. Therefore, the objective of this study was to determine if serine protease inhibitors affect the growth and viability of *P. marinus* cells *in vitro*. *P. marinus* was incubated with increasing concentrations of the protease inhibitors AEBSF (0.05-0.8 mM), aprotinin (0.25-4.0 mg/ml), α_2 -macroglobulin (12.5-200 μ g/ml), potato chymotrypsin inhibitor II (PCI, 25-400 μ g/ml) and soybean trypsin inhibitor (STI, 0.5-8 mg/ml). Propagation of *P. marinus* was then measured by three different methods: 1) turbidimetric, 2) cell counts and 3) intracellular reduction of tetrazolium salts. In addition, cell viability was measured by determining the percentage of cells taking up neutral red. AEBSF, PCI and α_2 -macroglobulin significantly inhibited the growth rate of *P. marinus* in a dose-dependent manner. In contrast, the highest concentration of STI increased the growth rate of *P. marinus* while aprotinin had no effect. The three methods used to quantify *P. marinus* proliferation gave similar results. Finally, cell viability was over 95% except for PCI. It is clear that certain protease inhibitors can be detrimental to *P. marinus in vitro*, while their potential effects *in vivo* remain to be determined.

***Student Presentation (LA)**

CONDITIONING OF EASTERN OYSTERS IN A CLOSED, RECIRCULATING SYSTEM.

John T. Buchanan^{1*}, Greg S. Roppolo², John E. Supan³, and Terrence R. Tiersch².

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As part of on going research in oyster genetics, techniques were developed for holding and conditioning Eastern oysters, *Crassostrea virginica* in a recirculating system. Oysters collected in February from a public oyster grounds (Hackberry Bay, Louisiana) were conditioned in a closed, recirculating system for 8 weeks. Water temperature in the system was gradually raised from 14°C, and held at 25°C for 6 weeks. Oysters were fed a diet of algal paste. Water quality, mortality, *Perkinsus marinus* infection, gonad development, and physiologic condition were monitored. At weeks 7 and 8, the laboratory oysters were compared to field controls (held at Grand Isle, Louisiana). Gonad development in the laboratory increased from immature or developing (100% of oysters sampled) at week 1 to mature (73% of oysters sampled) at week 8, although physiologic condition decreased. Field controls reached a higher mean gametic stage and were in better physiologic condition at the end of the study. These differences were attributed to differences in available nutrition between field and laboratory. This study demonstrates conditioning is possible in a recirculating system, and describes techniques advantageous for research. However, improvement in nutrition would be useful.

***Student Presentation (LA)**

COMPARISON OF DISSOCIATION OF OYSTER (*CRASSOSTREA VIRGINICA*) TISSUES WITH SEVERAL PROTEOLYTIC ENZYMES. Philip T. Cheng*¹, Jerome F. La Peyre¹, John T. Buchanan², Terrence R. Tiersch² and Richard K. Cooper¹. ¹Department of Veterinary Science, ²School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University, Baton Rouge, Louisiana.

Primary cell cultures of bivalve molluscs, including oysters, are being increasingly manipulated by researchers in various fields because cell lines are not currently available. In most studies, the techniques to establish these cultures vary greatly. Although several proteolytic enzymes have been used to dissociate cells from bivalve tissues, their efficiencies have never been compared. Our objective was to compare the dissociation of oyster tissues with trypsin (0.05%), pronase (0.1%) or collagenase (75 U/ml; 0.044%). The oyster tissues dissociated by these enzymes included heart atria and ventricle, and mantle. Each tissue was dissected, weighed, and minced. The tissue was divided into four equal parts and dissociated in saline with or without the enzymes. Following dissociation and rinsing, the number of single cells obtained was determined and total cell yields were calculated. Cell viability was evaluated using the fluorescent dyes calcein and ethidium bromide. The experiment was repeated five times. Data was analyzed by an analysis of variance with random block design followed by Duncan's multiple range test when significant differences were found ($P < 0.05$). For all oyster tissues, dissociation with pronase gave the best results with the highest total cell yields ($107 \pm 63 \times 10^6$ cells/g tissue, $N=15$) and cell viabilities ($89 \pm 4\%$, $N=15$).

***Student Presentation (LA)**

EFFECTS OF SUBSTRATE IN SIMULATED CRAWFISH BURROWS ON JUVENILE PRODUCTION AND WATER CHEMISTRY. James P. Bohannon^{1*}, Mark A. Konikoff¹, and Jay V. Huner². ¹Department of Biology, University of Southwestern Louisiana, ²Crayfish Research Center, University of Southwestern Louisiana.

Differences in juvenile production and water chemistry were tested in simulated crawfish burrows containing silt or clay soils compared to burrows containing water only. Juvenile production was higher for *Procambarus clarkii* than *P. zonangulus* in all treatments. Juvenile production was significantly higher in burrows containing silt than in the burrows containing water or clay, which did not differ. Simulated burrow water temperature, dissolved oxygen (D.O.), pH, conductivity, and ammonia (NH_3) concentration were measured over time. Dissolved oxygen was lower while pH was significantly higher in the burrows containing clay. Additionally, there were differences in conductivity and ammonia concentration among the treatments.

***Student Presentation (LA)**

DIET OVERLAP AMONG INLAND SILVERSIDE, YELLOW BASS, BLUEGILL, AND LARGEMOUTH BASS IN AN OXBOW OF THE MISSISSIPPI RIVER.

Michelle M. Puzo* and L.E. Miranda, Mississippi Cooperative Fish and Wildlife Research Unit, P.O. Box 9691, Mississippi State, Mississippi 39762.

Inland silverside, yellow bass, bluegill, and largemouth bass occur in the littoral zones of many oxbows along the lower Mississippi River. The first three species feed largely on invertebrates throughout their life cycle, whereas the latter one feeds on invertebrates during early ontogeny. In some instances, inland silverside and yellow bass are numerically very abundant in oxbows. Overlap in habitat and prey has prompted fisheries managers to question whether competition for food among these species may lead to the reduced recruitment of bluegill and largemouth bass often observed in oxbows. We collected these four species along the littoral zones of Eagle Lake, Louisiana-Mississippi, from mid-March through mid-July to assess temporal diet overlap. Principal foods in stomachs of inland silverside (cladocerans 48% by number, chironomids 16, ostracods 15, amphipods 14), yellow bass (eggs 53, amphipods 24, chironomids 14), bluegill (eggs 52, chironomids 19, cladocerans 19), and largemouth bass (cladocerans 44, amphipods 34) were invertebrates or eggs. Diet overlap assessed with Schoener's index indicated overlap between largemouth bass and yellow bass was generally less than 0.42 (no overlap = 0, complete overlap = 1, potential competition ≥ 0.6) and exhibited no discernable temporal trends; overlap between largemouth bass and inland silverside was as high as 0.81 in early May but decreased thereafter. Diet overlap between bluegill and yellow bass was as high as 0.9 and exhibited a decreasing trend through the sampling period; overlap between bluegill and inland silverside was as high as 0.63 and exhibited an increasing trend. Our results suggest that potential for competition among these species is real.

***Student Presentation (MS)**

SPATIAL AND TEMPORAL VARIATION OF FISH ASSEMBLAGES WITHIN A HIGHLY DISTURBED DRAINAGE BASIN. E. Lee Saxon* and Christopher M. Taylor, Department of Biological Sciences, Mississippi State University.

We collected fishes at 40 sites within the Luxapalila Creek drainage, Mississippi and Alabama, during the summer of 1997. Twenty-four sites corresponded to historical fish collections from the 1960s and 1970s. We examined historical and contemporary variation in fish assemblage structure of the Luxapalila Creek drainage in terms of overall species richness, relative abundance patterns of species (PSI), and community variation in multivariate space (DCA). Fish-environment relationships of contemporary collections were evaluated using canonical correspondence analysis (CCA). Overall, at both local and regional scales, species richness did not significantly change from one time period to the other. Upstream mainstem and small tributary sites showed greater variation than downstream mainstem creek sites. Assemblage variation in ordination space did not show a trajectory of change between historical and contemporary collections. The CCA indicated that fish assemblage structure was highly predictable based on environmental variables.

*** Student Presentation (MS)**

CONSERVATION OF THE LEOPARD DARTER IN OKLAHOMA AND ARKANSAS: A POPULATION VIABILITY ANALYSIS AND GENETICS APPROACH.

Lance R. Williams*¹, Anthony A. Echelle², and Alice F. Echelle². ¹Department of Biological Sciences, Mississippi State University, ²Department of Zoology, Oklahoma State University.

The leopard darter, *Percina pantherina*, is a federally threatened fish confined to five isolated rivers in the Ouachita mountains of southeastern Oklahoma and southwestern Arkansas. We conducted snorkeling surveys and used mark-recapture techniques to estimate population size for this species. In addition, we collected 101 total individuals from the five populations to use in a genetic survey. This sampling was conducted over three years (1995-1997), including one period of drought. We used these abundance estimates, along with life-history information and measures of environmental stochasticity, to perform a population viability analysis (PVA) for the leopard darter. We estimated that the probability of the leopard darter going extinct in 50 years was 6%. The severity of stochastic environmental events, such as drought, had the greatest effect on this model. These events, along with human activities in the region, may interact to make local populations susceptible to extinction. Despite these local effects, PVA indicated that the leopard darter metapopulation is relatively secure at current abundance levels. Knowing which factors interact to imperil leopard darter populations along with the degree of genetic diversity among these populations will be essential to ensure both current and long-term viability of this species.

***Student Presentation (MS)**

COLONIZATION AND EXTINCTION PROCESSES IN OUACHITA MOUNTAIN STREAM FISHES. Christopher M. Taylor¹ and Melvin L. Warren². ¹Department of Biological Sciences, Mississippi State University, ²Forest Hydrology Lab, 1000 Front Street, Oxford, MS.

Stream landscapes, like terrestrial landscapes, are typically patchy in space and time. Patchy resources may promote dispersal or migration of organisms among patches to fulfill life-history requirements. Furthermore, biotic and abiotic factors may limit patch occupancy. Thus, colonization and extinction events may be very important in determining the local composition of assemblages. We have been studying colonization and extinction dynamics of small Ouachita Mountain streams for two years, sampling fishes and the stream environment on a quarterly basis. Across all species, mean abundance was the most important predictor of colonizations and extinctions. At the assemblage level, colonizations and extinctions varied considerably. Colonizations occurred most frequently at larger stream localities where the potential species pool was the highest. Extinctions were most frequent at sites where temporal variability in stream depth was high. Assemblages at all sites formed temporally nested subsets indicating nonrandom patterns of colonization and extinction. This work supports the idea that local colonizations and extinctions of Ouachita Mountain stream fishes are dependent upon temporal variation in habitat and the dispersal abilities of species, and that these events occur in a non-random manner.

WATERSHED EVALUATION OF THE UPPER YALOBUSHA RIVER: FISHES.

Peter C. Smiley Jr., Scott S. Knight, and Charles M. Cooper. USDA-ARS, National Sedimentation Laboratory, Oxford, MS.

The upper Yalobusha River (upstream of Grenada Reservoir) is currently reflecting channel instability as numerous knickpoints migrate upstream in the main channel and tributaries. Additionally, a debris jam west of Calhoun City, Mississippi is creating an increased flooding problem. In 1996, the U.S. Army Corps of Engineers began examining possible solutions to both problems as part of the Demonstration Erosion Control (DEC) project in the Yazoo River basin. We surveyed fishes from the watershed to document the status of ichthyofauna prior to any project action. We sampled 33 sites representing a variety of habitat conditions from January to May 1997. Headwater and tributary sites were sampled using a backpack electroshocker, while riverine sites were sampled with both boat electroshocking and hoop nets. Overall, our collection contained representatives of 61 species from 17 families within 3971 captures. We documented the presence of 28 species which were previously unreported from this portion of the Yalobusha River drainage. In descending order, the five most abundant species captured were *Lepomis cyanellus*, *Ictiobus bubalus*, *Pimephales notatus*, *Lepomis macrochirus*, and *Semotilus atromaculatus*. This information will assist with evaluating the potential effects of debris jam removal or channel reconstruction on the ichthyofauna within this watershed.

STATUS, AGE, REPRODUCTION, AND DIET OF THE UNDESCRIBED SOUTHEASTERN BLUESUCKER, *CYCLEPTUS SP. CF ELONGATUS*. M.S. Peterson, L.C. Nicholson, D.J. Snyder and G.L. Fulling. USM Institute of Marine Sciences, Gulf Coast Research Laboratory.

We surveyed the Pearl and Pascagoula Rivers on 33 dates from February 1996 to January 1997 to evaluate the status and quantify aspects of the life-history of the undescribed southeastern Bluesucker. A total of 561 fish was observed and 322, ranging from 327 to 702 mm TL (4.0 to 43.1 kg WW), were collected. There was a significant difference in the slope of the TL-WW relationship between males and females (pooled by river, ANCOVA, $p < 0.02$, $n = 209$), with females exhibiting a steeper slope than males over the sizes studied. The sex-ratio was not different than 1:1 (Chi-square=2.4, $p = 0.121$). Gonadal recrudescence in females began in late August (mean GSI=1.3%) increased until late February (up to 14.9%), and decreased after mid-April (< 0.9%). Male bluesucker exhibited a similar pattern except GSI peaked abruptly in late September (mean GSI=7.4%), remained elevated until April (up to 5.1%), and decreased thereafter (< 0.9%). Diet (frequency of occurrence, $n = 206$) of all sizes of fish was dominated by Tricopteran larvae (83.0%), Chironomid larvae (76.2%), Coleoptera (32.5%), Ephemeroptera (29.6%), Plecoptera (23.3%), and Nematoda (17.5%), with sand (16.0%) and plant detritus (13.1%) being of lesser importance.

CONJUGATION AND TRANSFORMATION EFFICIENCY OF FISH PATHOGEN *Edwardsiella ictaluri* AND *E.coli* SM10 WITH SUICIDE DNA VECTOR. Jan H. Lousteau and Richard K. Cooper. Department of Veterinary Science, Louisiana State University.

Millions of dollars are lost every year in the catfish farming industry due to the fish pathogen *Edwardsiella ictaluri*. This pathogen causes an acute disease known as enteric septicemia of channel catfish (ESC). In this study, a DNA vector, pEIS, was designed to genetically alter the pathogen allowing further study of virulence factors and possible reduction of losses to the industry. The objectives of the experiment were to transfer DNA into virulent *E. ictaluri* 93-154 and to examine the transformation efficiency of a true suicide vector. The advantage of using a suicide vector is that target DNA containing a selectable marker is inserted into the genome of the bacteria without maintaining the vector. At that point, one could test for a mutant where insertion had occurred in a virulence gene. The gene could be further studied enabling development of vaccines or other methods to combat the disease. Conjugation provided a method for a high transformation efficiency. In the future, this vector could be used to mutate and study genes of interest in other organisms.

***IN-SITU* POLYMERASE CHAIN REACTION: A POWERFUL TOOL FOR DETECTION AND LOCALIZATION OF DNA SEQUENCES IN FISH GENOMES.**

Quiyang Zhang¹, Richard K. Cooper¹, and Terrence R. Tiersch². ¹Department of Veterinary Science, ²School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803.

In-situ hybridization (ISH) has developed into a standard technique for visualization of DNA sequences in cells, on nuclei, and on chromosomes. An inherent limitation of this technique is that multiple copies of a target sequence are required for efficient detection, preventing successful use of the technique for location of single- or low-copy genes. In this study, we introduced a newly developed technology, *in-situ* polymerase chain reaction (ISPCR), for detection and localization of single- or low-copy genes in fish genomes. The technique consists of following major steps: DNA primer design, synthesis and labeling of primers, preparation of whole-cell, nuclei, or chromosomes on microscope slides, *in-situ* amplification and hybridization, detection of hybridization signals. These techniques have been used to analyze single-locus genes such as immunoglobulin and ribosomal RNA of channel catfish. Other studies undertaken include determining incorporation and integration of foreign genes in the genomes of transgenic fishes. Application of the ISPCR is just beginning for fish genetics, and awaits further development and modification for wide application.

TRANSFER OF A HERITABLE GENE INTO KOI CARP USING LIPOFECTION. Brandye Sawyer Smith¹, Richard K. Cooper¹, and Terrence R. Tiersch². ¹Department of Veterinary Science, Louisiana Agricultural Experiment Station, Louisiana State University; ²School of Forestry, Wildlife and Fisheries, Louisiana State University.

Aquaculture has become a valuable industry for the Southeastern United States, including Louisiana. In 1997 it was estimated that catfish farmers boosted Louisiana's economy by \$200 million dollars. However, the biggest problem facing aquaculture is disease. Every year infectious diseases kill 10% of farmed fish and generate a 55% loss in profit. A gene delivery technique known as lipofection would be indispensable if it provided commercially valuable transgenic broodstock with heritable traits beneficial to fish survival. We have used lipofection to transfer a lytic peptide gene into the genome of male Koi carp (*Cyprinus carpio*). The gene is carried within a plasmid coupled to liposomes, which carry the DNA across cell membranes. Once the plasmid associates with the fish DNA, the gene can incorporate into the fish genome. After the presence of this gene was confirmed in blood cells by polymerase chain reaction (PCR), the fish were spawned artificially with normal females. PCR verified progeny from the transgenic males that contained the lytic peptide gene after one year. Stable incorporation of a transgene in fish allowing defense against pathogenic invasion that is inherited by offspring would enhance the success of the aquaculture industry. This model demonstrates the feasibility of applying this technique to other fishes, including channel catfish.

AN ECONOMIC CASE STUDY ON THE PRODUCTION OF HYBRID STRIPED BASS SPERM WITH CRYOPRESERVED SPERM. Rex H. Caffey* and Terrence R. Tiersch. School of Forestry, Wildlife, and Fisheries, Louisiana State University Agricultural Center, Louisiana Experiment Station, Baton Rouge, LA

United States production of hybrid striped bass expanded rapidly in the 1990=s, becoming one of the fastest growing segments of American aquaculture. However, hatchery production is constrained because the spawning seasons of parental basses only partially overlap, and the species are not always found in the same location. Louisiana State University recently initiated a research project to examine the technical and economic feasibility of overcoming these limitations through cryopreservation-based hybridization using the sperm of temperate basses (*genus Morone*). This paper compares the economic requirements of cryopreservation-based hybridization with traditional spawning regimes for the production of hybrid striped bass. All relevant costs are identified from broodstock collection through spawning and compared over a range of fertilization rates. These results suggest potential applications for ongoing research.

***Student Presentation (LA)**

ASSESSMENT OF VIABILITY OF TILAPIA SPERM WITH DUAL DNA-STAINING AND FLOW CYTOMETRY. Manuel Segovia¹, Jill A. Jenkins², Carmen Paniagua¹, Terrence R. Tiersch¹, Robert Reigh¹. ¹LSUAC, LAES, School of Forestry, Wildlife and Fisheries, Baton Rouge, LA, ²National Wetlands Research Center, Biological Resources Division, USGS, USDI Lafayette, LA.

Improved storage of gametes from tilapia, *Oreochromis niloticus*, would enhance breeding programs around the world. The objective of this study was to optimize methods for collection, handling, storage, and quality assessment of tilapia sperm. Concentrations of 1×10^9 sperm/ml were suspended in Ringer's Buffer (RB) at 318 mOsmol/kg (pH 8.0) were used. The fluorescent dyes rhodamine 123 (0.13 μ M) and propidium iodide (2.4 mM) were used to stain the cells. A temperature of 70 °C for 10 min was used to produce known dead cells, and a standard curve for live:dead cell mixtures was generated. Percent viabilities were determined for ratios (live:dead) of 100:0, 75:25, 50:50, 25:75, and 0:100. To study short-term storage, sperm were kept at 4 °C for 12 days in RB, RB with antibiotics (ampicillin or gentamicin), or RB with penicillin/antimycotic solution. Viabilities were assessed daily for 12 days. This study demonstrated the utility of this staining combination for use with sperm cells, and that antibiotics can increase storage of tilapia sperm.

HOMOLOGY OF *SUL I* SEQUENCES AMONG DIFFERENT BACTERIAL SPECIES. Scott Rodgers¹, Dr. Richard Cooper¹, Dr. Cliff Starliper². ¹ Louisiana State University, Department of Veterinary Sciences, 111 Dalrymple Building, Baton Rouge, LA 70803. ² USGS National Fisheries Research Laboratory, 1700 Leetown Road, Kearneysville, WV 25430.

Antibiotic resistance is widespread. One such resistance affecting aquaculture is Romet resistance. Romet is a potentiated sulfonamide drug composed of 5 parts sulfadimethoxine and 1 part ormetoprim. Resistance to this drug is caused by the *sul* genes – *sul I*, type I resistance and *sul II*, type II resistance. The study focused on type I Romet resistance encoded by *sul I*. The objectives were: 1) to sequence *sul I* genes in different bacterial species, and 2) compare the sequences to determine if sequence homology existed. Bacterial species of *Aeromonas salmonicida*, *Edwardsiella ictaluri*, *Pastuerella piscicida*, and *Escherichia coli* were analyzed for the presence of *sul I* using PCR. All the isolates studied, that were resistant to Romet, contained *sul I*. When the *sul I* sequences of these bacterial species were analyzed and compared, sequence homology was found to exist.

STERILIZATION OF THE MALAYSIAN PRAWN, *Macrobrachium rosenbergii*.

Nyanti Lee* and Terrence R. Tiersch. School of Forestry, Wildlife and Fisheries, Louisiana Agricultural Experimental Station, Louisiana State University, Agriculture Center, Baton Rouge, LA 70803.

The giant Malaysian prawn, *Macrobrachium rosenbergii*, is farmed in many parts of the world. However, their cannibalistic nature and social suppression of growth present obstacles for culture of this species. Production of non-reproductive populations may eliminate these problems and yield homogeneous growth that result in increased return for commercial culture. Ionizing radiation techniques have been used to produce sterile insects (such as *Dacus dorsalis*) and fish but little is known about the effects of irradiation on crustaceans. A preliminary study on the effects of cobalt-60 gamma irradiation on postlarva and juvenile Malaysian prawns indicated that mortality increased with dosage. After exposure to 3,000 rads (3×10^5 ergs of energy dissipated in 1 g of irradiated material), complete mortality occurred between 12 and 14 days in postlarval (55 - 62 d old) and juvenile (90 - 97 d old) prawns. At 1,000 rads, mortality of juveniles was lower (2%) than mortality of postlarvae (71%). The effects of gamma irradiation on osmoregulation addressed the effect of environmental salinity on hemolymph osmolality, hemolymph chloride levels, and water content of juveniles prawn. Future work will concentrate on irradiating embryos and larvae at doses below 3,000 rads in an effort to design economically feasible and efficient ways to produce sterile Malaysian prawns for aquaculture.

***Student Presentation (LA)**

THE FISH COMMUNITY AT AN OIL PLATFORM SIX MONTHS AFTER AN EXPLOSIVE EVENT. Jim Bolden*, David Stanley, and Charles Wilson. Coastal Fisheries Institute, LSU-CCEER, Baton Rouge, LA 70820

An oil platform in the northern Gulf of Mexico was visited six months after explosive charges were used to sever the conducting wells. This means of oil well removal is often controversial due to potential deleterious effects on marine life. Density, numbers, and species composition were determined at the site utilizing a combination of hydroacoustics and visual surveys with a remote operated vehicle. Significant differences were seen in the community between the side of the platform surveyed, time of surveying, depth, and distance from the platform. Estimated number of fish at the platform were consistent with previous studies, suggesting a rapid immigration to the site post blast.

***Student Presentation (LA)**

IMPACTS OF EXPLOSIVE SALVAGE OF OFFSHORE OIL AND GAS PLATFORMS ON FISHERIES IN THE GULF OF MEXICO. Gregg R. Gitschlag, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory.

There are more than 4,000 oil and gas structures present in the U.S. Gulf of Mexico. Approximately 100 structure removals occur each year and 66% of these are removed with explosives. Since 1993 an intensive study was conducted on the fish kill resulting from the explosive removal of selected platforms off the Louisiana coast. Preliminary results from this ongoing study are reported for 7 platforms in water depths ranging from 14-28 m (45-92 ft). After explosives were detonated, all floating fish and a sample of the dead fish which sank to the sea floor were collected. Estimated fish mortality ranged from approximately 2,000-6,000 with a mean of 3,300 and standard deviation of 1,338. The four most abundant species impacted by underwater explosives included spadefish, blue runner, red snapper, and sheepshead. These 4 species accounted for an estimated 90% of the fish killed at the platforms studied. Estimated mortality of red snapper ranged from 0-1200 with an average per platform of 555 with standard deviation of 406. Sixty-eight percent of all collected red snapper mortalities were under the legal size limit of 15 inches. Although fish measuring <8 cm were usually small in number and not targeted for sample collection, a statistically valid sample was taken at one platform where an abundance of small fish were observed. Estimated mortality in the footprint area under the platform for fish measuring <8 cm was 6400 with 6100 of these being lane snapper.

MONITORING THE IMPACTS OF ENVIRONMENTAL PERTURBATIONS ON COMMERCIAL FISHERMEN. Terry L. Romaine, Michelle Kasprzak, and Jim Hanifen. Louisiana Department of Wildlife and Fisheries.

The Louisiana Department of Wildlife and Fisheries has collected fisheries independent environmental monitoring data in the Northern Gulf of Mexico under several different programs that have contributed to the understanding of hypoxic bottom waters off the Louisiana coast, first documented in 1935. The Coastal Study Area fishery management program began in 1966. The state-mandated LOOP environmental monitoring program collected data between 1978 and 1995; and the federal SEAMAP monitoring program, which began in 1982, continues today. This data has identified variable yet persistent oxygen-depleted bottom waters during summer known as the hypoxic zone. The impacts of this zone on fisheries vary and include the following: concentration of fishing effort leading to increased harvest and localized overfishing in some areas, shellfish mortality if this area impinges on coastal bay waters, localized mortality of finfish and shellfish, and decrease in recruitment of fisheries due to impacts to zooplankton species assemblages and larval fish species.

This spring the Department is beginning a large scale effort to identify inshore hypoxic fronts by collection and analysis of profiles of dissolved oxygen and associated hydrological data and relate this environmental data directly to fishery effort determined by a logbook survey involving commercial Louisiana fishermen. This effort is projected to last three years and to produce badly needed fisheries correlations to the hypoxic zone.

UNDERWATER OBSTRUCTIONS IN LOUISIANA'S COASTAL WATERS AND THE GULF OF MEXICO. Jeffrey K. Rester¹, Allan G. Pulsipher², and Dmitry V. Mesyanzhinov²
¹Gulf States Marine Fisheries Commission. ²Center For Energy Studies, Louisiana State University.

Underwater obstructions are a problem that plague everyone who navigates in Louisiana's coastal waters and the Gulf of Mexico. Thousands of potentially dangerous underwater obstructions exist off Louisiana. The term underwater obstruction is used to refer to anything that restricts, endangers, or interferes with navigation, commercial or recreational fishing, or future oil and gas exploration or development. Underwater obstructions have many different origins. Thousands of miles of abandoned and active pipelines, improperly abandoned oil and gas structures and related debris, equipment purposely dumped or accidentally lost overboard from supply vessels and cargo ships, sunken boats and barges, pipelines and other facilities originally located on dry land but now under water because of subsidence and erosion, all contribute to the problem. Underwater obstructions are serious threats to human life and safe navigation along the Louisiana coast. They are also expensive. Oil and gas companies are assessed millions each year to mitigate the effects of underwater obstructions to a select few. Mitigating the effects still does not solve the underwater obstruction problem. The Louisiana Department of Natural Resources is currently implementing a program to remove underwater obstructions, but funding is limited. Other incentives to remove obstructions also need to be created, along with identifying funding sources for the removal program.

REVISING THE NATION'S ARTIFICIAL REEF PLAN. Ronald R. Lukens. Gulf States Marine Fisheries Commission.

In 1984, the U.S. Congress passed the National Fishing Enhancement Act. The Act mandated the development of the National Artificial Reef Plan through the National Marine Fisheries Service. By the end of 1985, the National Plan was complete, having been developed by a multi-disciplinary group of over thirty individuals. The Plan establishes broad guidance regarding artificial reef development and management, and stresses the importance of planning for increasingly smaller geographic areas. Most U.S. coastal states have adopted a state plan in some form, or are in the process of developing such a plan. The National Plan was intended to be a document subject to periodic revision. Since its adoption in 1985, there has been a periodic international conference providing a focal point for presentation of current research and data, the Gulf and Atlantic Commissions have provided for regional planning, most states now have state plans, and the fisheries management potential of artificial reefs is now recognized. These developments led to the conclusion that a thorough review and revision of the National Plan was overdue. The first draft of the revision of the National Plan has recently been completed and contains the following topics of significance for which changes are being proposed.

Permits
Mitigation
Objectives of individual reef
Reefs as a fisheries management tool
Evaluation and monitoring

THE FUTURE IMPLICATIONS OF ESSENTIAL FISH HABITAT. Jeffrey K. Rester, Gulf States Marine Fisheries Commission.

Amendments to the Magnuson-Stevens Fishery Conservation and Management Act in 1996 required Regional Fishery Management Councils to amend their Fishery Management Plans (FMP) to describe and identify Essential Fish Habitat (EFH). The amendments must also identify adverse impacts from both fishing and non-fishing activities on EFH, and identify actions to conserve and enhance EFH. Habitats that are necessary to the species for spawning, breeding, feeding, or growth to maturity will be described and identified as EFH. These habitats will be described narratively and geographically in the FMPs. Also in the FMPs Councils must assess the potential adverse effects of all fishing equipment types on EFH and must include management measures that minimize adverse effects to the extent practicable. Councils are also directed to examine non-fishing sources of adverse impacts that may affect the quantity or quality of EFH and to consider actions to reduce or eliminate the effects. Finally, Councils are directed to identify proactive means to further the conservation and enhancement of EFH. The EFH amendments to the Magnuson-Stevens Act also provide procedures to promote the protection of EFH in the review of Federal and state actions that may adversely affect EFH. This protection is in the form of conservation recommendations from the Councils and the National Marine Fisheries Service (NMFS) to the appropriate Federal or state agency.

SOUTHEAST AREA MONITORING AND ASSESSMENT PROGRAM (SEAMAP). A STATE/FEDERAL COOPERATIVE DATA COLLECTION PROGRAM FOR THE SOUTHEAST UNITED STATES. David M. Donaldson, Gulf States Marine Fisheries Commission.

The Southeast Area Monitoring and Assessment Program (SEAMAP) is a State/Federal/university program for collection, management and dissemination of fishery-independent data in the southeastern United States. The program presently consists of three operational components, SEAMAP-Gulf of Mexico, -South Atlantic, and -Caribbean. Activities and operations of each SEAMAP component are defined by the SEAMAP-Gulf Subcommittee; SEAMAP-South Atlantic Committee and the SEAMAP-Caribbean Committee. The committees consist of representatives from each member state, NMFS, regional fishery management councils as well as other interested agencies. One of the goals of SEAMAP is utilization of standard sampling gears and methodologies. For trawl surveys, sampling activities occur during day and night and stations are randomly-selected and stratified by depth. The vessels use either a standard 40-ft or 20-ft otter trawl. For plankton surveys, stations are arranged in intervals of 30 miles. Bongo samplers consist of two conical 61-cm nets with 333-micron mesh. Neuston samplers consist of 948-micron mesh nets on 2 x 1-meter frames. In conjunction with each trawl and plankton station, environmental data are also collected. SEAMAP has been conducting various surveys during the past fifteen years. The major surveys include the Spring Plankton, Summer Shrimp/Groundfish, Fall Plankton, and Fall Shrimp/Groundfish Surveys. Information is provided to user groups via three systems: SEAMAP Information System, SEAMAP Archiving Center, SEAMAP Invertebrate Plankton Archiving Center. These systems provide the data to interested personnel for research and other uses. SEAMAP publishes documents which include Real-Time Mailouts, SEAMAP Marine Directory, TCC SEAMAP Report, Joint Annual Report and the SEAMAP Atlas.

ABSTRACTS

For posters presented at the joint Mississippi and Louisiana Chapter AFS Meeting, February 4-6, 1998, Casino Magic, Bay St. Louis, MS

FIRST REPORT OF A SHARKSUCKER (*ECHENEIS NAUCRATES*) ON A BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*), AND A REEVALUATION OF REMORA-CETACEAN ASSOCIATIONS. Dagmar Fertl¹ and Andre M. Landry, Jr.² ¹ Marine Mammal Research Program, Texas A&M University, 4700 Avenue U, Galveston, TX 77551, USA (current address: Minerals Management Service, U.S. Dept. of Interior, 1201 Elmwood Park Blvd., New Orleans, LA 70123, USA), ² Dept. of Marine Biology, Texas A&M University, 4700 Avenue U, Galveston, TX 77551, USA.

A 259-cm male bottlenose dolphin (*Tursiops truncatus*) with three attached echeneids live-stranded in Galveston, Texas, on 29 October 1995. Efforts to rescue the dolphin for subsequent rehabilitation dislodged all but one echeneid. This 119-mm (standard length) specimen was collected and identified, on the basis of fin-ray counts and shape and number of disc lamellae, as a sharksucker (*Echeneis naucrates*). Prior to this discovery, *Remora* (= *Remilegia*) *australis* was the only echeneid thought to utilize cetaceans as a host, hence its common name "whalesucker."

Unlike the aforementioned dolphin stranding, whereby the sharksucker was retained and physically examined, most echeneid-cetacean associations described in the literature are based on visual or photographic observations of a remote, free-swimming host and its passenger(s). "Remote" identifications mandate caution when classifying remoras found on cetaceans as the whalesucker. The possibility that small, slender remoras as well as more stocky echeneids photographed on cetaceans may represent different life history stages of one species further complicates positive identification. The sharksucker-dolphin association described herein suggests at least two echeneid species utilize cetaceans as a host.

EFFECTS OF WATER FLOW ON FORAGING STRATEGIES OF THE BLUNTFACE SHINER (*Cyprinella camura*). Sherry L. Harrel and Eric D. Dibble, Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762.

Previous studies suggest large energetic costs in high water flows alter foraging strategies of stream-dwelling cyprinids. Specialization on prey items decreases as water flow increases, because more energy is utilized to maintain position in the water column. To test this hypothesis, we conducted a laboratory experiment in a plexiglass flume. Rate of energy gain (R) and selectivity (D) of food items by bluntface shiners (*Cyprinella camura*) were measured in three flow treatments and replicated 12X. Fish were recorded in a foraging arena within the flume with a VHS-C video camera. Holling's disc equation was used to obtain the average rate of energy gain (R) and Jacob's selectivity index (D) was used to determine selectivity. *Foraging and success rates*, *energy expenditure* (caudal fin beats/sec) and *handling times* were measured with focal samples (10 minute durations). Bluntface shiners preferred artificial food over natural food items across all three flow treatments. Rate of energy gain decreased as water flow increased ($R = 2.4 - 0.6$). The ability to remain selective on one food type may suggest bluntface shiners can acclimate to environmental changes of water flow, however, advantages may be limited because of larger energetic requirements.

FACTORS INFLUENCING STOCK STRUCTURE OF PRINCIPLE SPORT FISHES IN IMPOUNDMENTS LOCATED ON NATIONAL FORESTS IN MISSISSIPPI. Donald C. Jackson¹ and Nancy J. Brown-Peterson². ¹Department of Wildlife and Fisheries, Box 9690, Mississippi State, MS 39762. ²Gulf Coast Research Lab, Ocean Springs, MS 39566.

Small watershed impoundments provide the principal recreational fishing opportunities within national forests in Mississippi. Relative abundance and stock structure of bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) were assessed by electrofishing 18 national forest impoundments during spring 1990, autumn 1990, and spring 1991. There were no significant year-to-year or seasonal differences in catch per unit effort (CPUE) or proportional stock density (PSD) for either species. Mean CPUE for stock-size bluegill (total length ³ 200 mm) ranged from 8.2 to 9.7 fish/hour of electrofishing and mean PSD ranged from 14.0 to 22.5. Mean CPUE for stock-size bluegill (total length ³ 80 mm) ranged from 38.7 to 45.0 fish/hour and mean PSD ranged from 21.5 to 21.8. Twenty-five habitat, accessibility, and watershed variables were evaluated by multiple regression techniques to determine factors that significantly described largemouth bass and bluegill CPUE and PSD. Conductivity, population of the nearest town, and the percentage of upland hardwoods in the watershed accounted for 73% of the variation in bluegill CPUE, while 57% of the variation in largemouth bass CPUE was explained by surface dissolved oxygen, distance to the nearest paved road, and the percentage of wetlands in the watershed. Variation in bluegill PSD was best described by alkalinity, distance to the nearest paved road, and chlorophyll *a* concentration ($R^2 = 61$), while the population of the nearest town, chlorophyll *a* concentration and the percentage of upland hardwoods in the watershed accounted for 67% of the variation in largemouth bass PSD. These models suggest that emphasis should be placed on impoundments located in watersheds compromised principally of hardwoods. Improving water quality (i.e., fertility) of these impoundments should receive priority by fisheries managers, followed by management orientations addressing watershed characteristics and angler exploitation of the fish stocks. Application of fertilization programs with wetland-connected impoundments should probably be avoided in order to maintain the integrity of wetland characteristics which may be sensitive to artificial nutrient loading.

SAMPLING FISH IN SUBMERSED AQUATIC PLANTS. K. Jack Killgore. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

We commonly use four techniques to determine species richness and abundance of fishes in structurally-complex habitats. Popenets estimate fish density in dense aquatic plant beds and are effective in sampling juvenile sunfishes and other small species. A boat-mounted electroshocker is used to evaluate relative abundance of larger, more mobile fishes that utilize the edge of dense plant beds. Quadrat seining is used to sample shoreline fishes adjacent to dense plant beds. Light traps collect larval fishes and provide data to evaluate spawning and rearing value of different plant habitats. Sampling constraints in aquatic plants require the use of multiple techniques to accurately portray fish communities in vegetated water bodies.

STATUS OF FRESHWATER MUSSEL POPULATIONS IN MAJOR TRIBUTARIES OF TOMBIGBEE RIVER SYSTEM, MISSISSIPPI. C.L. Knight 1 , R.L. Jones 1 , P.D. Hartfield 2 , T. C. Majure 1. 1 Mississippi Museum of Natural Science, 111 N. Jefferson St. Jackson, MS 39202; 2 U. S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Jackson, MS 39213.

Ten of the approximately 40 species of freshwater mussels reported from the Tombigbee River system in Mississippi and Alabama have been listed as threatened or endangered by the U. S. Fish and Wildlife Service (*Epioblasma penita*, *Lampsilis perovalis*, *Medionidus acutissimus*, *Pleurobema curtum*, *P. decisum*, *P. marshallii*, *P. perovatum*, *P. taitianum*, *Potamilus inflatus*, *Quadrula stapes*). Between 1988 and 1995 we surveyed mussels in 5 tributaries of the Tombigbee River system in Mississippi (Buttahatchee River, East Fork Tombigbee River, Luxapallia Creek, Noxubee River, Tibbee Creek). Results indicated an extensive decline in mussel populations and limited reproduction and recruitment for most species. We attributed declines to habitat loss resulting primarily from severe and accelerated channel erosion, siltation and poor water quality. Some species have been extirpated from historical collecting localities as a result of channel modification and impoundment. *Pleurobema marshallii*, *P. taitianum* and *Quadrula stapes* have not been found alive in the in the past decade. *Epioblasma penita* and *Pleurobema curtum* apparently only survive in some reaches of the Buttahatchee and East Fork Tombigbee Rivers, respectively. *Potamilus inflatus* probably no longer occurs in our study area. Although suitable habitat remains in some areas, channel erosion and degradation continue to threaten mussels in the Tombigbee River system.

ENVIRONMENTAL VARIATION AND EARLY GROWTH OF IMPORTANT ESTUARINE FISHES: DEVELOPMENT OF AN APPROACH TO ASSESS ENVIRONMENTAL CHANGE. Mark S. Peterson, Chet F. Rakocinski and Bruce H. Comyns. USM Institute of Marine Sciences, Gulf Coast Research Laboratory.

Estuaries are highly variable, productive ecosystems that can be viewed as a mosaic of spatially and temporally distinct habitats which are used by a myriad of nekton during all or part of their life history. Determining linkages between variability in abiotic parameters and growth in both the lab and field will further our understanding of factors that affect recruitment success. Growth measured as change in wet weight (WW) was significantly higher in 5 than 20‰ in age-0 croaker (*Micropogonias undulatus*). Moreover, fish exposed to the decreasing treatment of 20 to 5‰ exhibiting intermediate growth (ANCOVA, $p < 0.03$, $n = 11$), suggesting an additive effect of changing salinity on growth. The width of the translucent portion of the otoliths, i.e., the portion that grew during the lab experiments, was significantly greater from fish in 5‰ than the 20‰ treatment (ANOVA, $p < 0.002$, $n = 51$). These differences in WW change were reflected in growth of otoliths ($r = 0.76$, $p < 0.007$, $n = 11$). In the field, substantial fluctuation in the early growth of age-0 croaker was inversely cross-correlated with water temperature and salinity at a lag of +1d over the time period of the laboratory experiments. Together with the field data, the results of the lab experiments by illustrate that salinity is one of a suite of important factors influencing growth of age-0 croaker. Assuming that the probability of survival during the nursery period is an increasing function of body size, environmental plasticity in growth implies that the site and habitat into which post-larval fish settle can indeed have a marked influence on recruitment dynamics. This study demonstrates that there is the potential for salinity fluctuations to cause significant variability in short-term growth rates for juvenile fishes across an estuarine nursery.

ZEBRA MUSSEL RESEARCH PROGRAM. Larry G. Sanders and Dr. Edwin A. Theriot. U.S. Army Corps of Engineers, Waterways Experiment Station.

It is estimated that the Corps of Engineers and other public water management and power facilities are spending over \$100M annually to prevent catastrophic shutdown of their facilities due to biofouling by zebra mussels. This figure is expected to increase to over half a billion dollars annually by the year 2000. The Zebra Mussel Research Program is authorized by the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (PL 101-646) and the National Invasive Species (NIS) Act of 1996 (PL 101-646 as amended). The ZMRP is the only Federally authorized research program for the development of technology to control zebra mussels. Under the authority of the NIS it is scheduled for completion in FY 2002. Research areas include the development of control methods (e.g. filters, evaluation of antifoulant coatings, chemical treatment, cathodic protection, and biological control, etc.), evaluating ecological impacts, and constructing predictive models to assess risk and develop management strategies.