PROJECTS 1996-98

LOUISIANA Sea Grant

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Sea Grant

Louisiana State University

LOUISIANA SEA GRANT COLLEGE PROGRAM

Louisiana Sea Grant at LSU, now 28 years old, integrates coastal and marine research, education, and advisory services in a flexible, interdisciplinary program that responds rapidly to state, regional, and national needs. In laboratories, in classrooms, in the workplaces of the state's citizens, in marshes, bays, and waterways, Sea Grant research concentrates on solving natural resource problems of economic and ecological significance from aquaculture to marsh erosion.

Since 1968, Louisiana Sea Grant has supported more than 500 projects through Louisiana State University, the University of Southwestern Louisiana, the University of New Orleans, Nicholls State University, Tulane University, the Louisiana Universities' Marine Consortium, and other institutions. To qualify for Sea Grant support, projects must be scientifically sound, practical, both locally and nationally relevant, and capable of completion within two to four years.

Louisiana Sea Grant is part of the National Sea Grant College Program under the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Created by Congress in 1966, Sea Grant is now a network of 30 Sea Grant Colleges—which provide access to the skills and resources of over 300 universities and institutions—the program is dedicated to encouraging the national development of marine and coastal resources while conserving and managing them wisely.

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CONTENTS

PROGRAM MANAGEMENT AND DEVELOPMENT

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The direction of a Sea Grant College Program requires the blending of managerial and administrative ability with a thorough understanding of the unique marine resources, problems, and opportunities in the program's jurisdiction. The challenge is to identify research needs that befit Sea Grant's purpose and the priorities of the state of Louisiana; to allocate scarce resources in mobilizing university research talent to pursue practical solutions; to oversee effective program operations, planning, and fiscal accountability; and to respond quickly to research and service opportunities that occur out of phase with the normal budget cycle.

Another major function is the development of strategies to acquire funding from related NOAA—and other federal or state—programs that can supplement and complement core Louisiana Sea Grant efforts in research, education, advisory services, and technology transfer.

RESEARCH

The projects described here comprise Louisiana Sea Grant's current core program from 1996 through 1998. The projects address problems in five major categories that have been identified as especially pertinent to state, regional, and national needs: aquaculture, coastal and wetland resources, economic and community development, natural fisheries, and seafood products. Also included are program development projects, those of shorter duration funded outside the normal two-year proposal cycle. Publications and other products resulting from these activities will be made available by the Louisiana Sea Grant communications office as they are produced.

AQUACULTURE

Micro-Design of Media for Use in Floating Bead Filters in Recirculating Aquaculture Systems

Ronald F. Malone, LSU Department of Civil Engineering, Aquatic Systems Laboratory

Doubling the carrying capacity of commercial floating bead filters will significantly reduce the capital costs associated with clarification and biofiltration in recirculating systems. This can be done with a bead design that will prevent the excessive biofilm damage associated with the frequent washing needed to control sludge-produced ammonia in the filtration beds. In this project, the researcher will develop a bead design that will improve bed porosity and biofilm retention, test the

design against currently used bead configurations, and demonstrate the use of the new design in a system with an overall carrying capacity of at least three pounds of feed a day per cubic foot of the floating bead medium.

Development of Production Guidelines for and Evaluation of Microalgal Products From a Hydraulically Integrated Serial Turbidostat Algal Reactor (HISTAR)

Kelly A. Rusch, Ronald F. Malone, LSU Department of Civil Engineering, Aquatic Systems Laboratory

For greatest reliability and stability, the researchers believe that the design of large-scale microalgae production systems should be based, first, on the control of contaminants and, secondly, on productiveness. This project will develop guidelines for the operation of a serial turbidostat algal reactor called HISTAR, in which contaminants are continuously washed out before they can damage the growth and health of the algae being produced. The researchers will determine the factors influencing both contaminant washout and algae production and develop strategies for controlling the process.

Development and Testing of Tetraploid *Crassostrea virginica* Broodstock for Producing Triploid Oysters

John Supan, LSU Office of Sea Grant Development
Charles Wilson, LSU Coastal Fisheries Institute

Oysters are normally diploid—that is, they have only two sets of chromosomes—but, in the laboratory, oysters with three sets (triploids) can be produced. Triploid oysters don't spawn and so remain fat all summer, unlike diploids, which use up their stored glycogen in the spawning process and yield lean, poor quality meat during the summer months. Thus, the harvest of triploids during the reproductive season could help to prevent seasonal economic losses for oyster processors and to provide a half-shell product more pleasing to the consumer. To avoid the high rate of egg mortality associated with the chemicals used to induce triploidy, the researchers will use previously developed procedures to first make tetraploid oysters (which have four sets of chromosomes). These will be crossed with diploids to produce triploid oysters. The researchers will evaluate the use of cryopreserved sperm from tetraploid oysters to produce triploids in a hatchery.

COASTAL AND WETLAND RESOURCES

Marsh Restoration with Dredged Sediment: The Effect of Differential Sediment Addition on Salt Marsh Structure and Function

Irving A. Mendelssohn, LSU Wetland Biogeochemistry Institute

The severe degradation of Louisiana's coastal wetlands is caused primarily by the lack of new sediment to sustain health and growth. The addition of dredged sediment to deteriorating marshes is a potential method for reducing wetland loss but there are many information gaps. How much sediment should be added? What

are the ecological consequences of adding too much or too little? How can we predict the rates of compaction of dredged sediment? This project will determine the factors that control successful restoration and rehabilitation of deteriorated wetlands by sediment addition. The researchers will determine the effects of sediment thickness, patterns of water movement, and sediment chemistry on the structure and function of a tidal salt marsh that has received dredged sediment.

Assessing the Capacity and Mechanisms for Wetland Assimilation of Sediments and Nutrients in Diverted Mississippi River Water

John W. Day, Jr. and G. Paul Kemp
LSU Coastal Ecology Institute

Deltaic wetland systems throughout the world are undergoing submergence at an accelerated rate because river dikes have cut off the nutrients and sediments that previously sustained their growth. The introduction of sediment and nutrient-laden fresh water will offset the detrimental effects of the dikes and restore large wetland areas, but the details of the specific restorative processes remain largely unexplored. A careful examination of these processes will provide guidance for the design of future diversions and improve the operation and monitoring of existing projects. The researchers will quantify the rate at which coastal wetlands use or process nutrients and sediments as diverted Mississippi River water passes through them; elucidate the specific pathways followed by the nutrients as they are assimilated by the ecosystem, develop monitoring techniques to track the response of the ecosystem, and estimate the loading rates required to improve wetland sustainability by offsetting the effects of relative sea-level rise. The ultimate goal is to improve the design and operation of diversion structures to offset coastal land loss without impairing other ecosystem functions.

Estuarine Eutrophication: Reconstruction of Historical Changes and Prediction of Future Events

R. Eugene Turner, LSU Coastal Ecology Institute
Nancy N. Rabalais, Louisiana Universities Marine Consortium
Quay F. Dortch, Louisiana Universities Marine Consortium

Changes in nutrient concentrations in the Mississippi River over the last 30 years have profoundly affected estuarine water quality, as have changes in local water quality. The purpose of this project is to identify the changes in nutrient loading and assess their effects on Louisiana's estuaries through an examination of water quality and sedimentary records. Observed changes will be interpreted in light of present trends and anticipated future changes. Approaches will include the reconstruction of water quality records, analysis of sediment cores for phytoplankton pigments, analysis of diatom distribution and quantity, dating of cores to establish a time sequence, analysis of trace metals and sedimentary structure, and land-use modeling.

ECONOMIC AND COMMUNITY DEVELOPMENT

Oyster Fishermen and the Local Economy: A Study of Labor Displacement in the Louisiana Oyster Industry

Forrest A. Deseran and John J. Beggs, Louisiana Population Data Center,
LSU Department of Sociology

The oyster industry is an integral part of Louisiana's coastal economy, but it is plagued by problems. In some areas, poor water quality has resulted in widespread lease closures. In others, coastal restoration projects have unfavorably changed the salinity content of the water. An impending FDA seasonal ban on raw oysters from the gulf threatens the existence of a large part of the industry. Although the problems are clearly identified, there has been little study of the sociological consequences. This project is designed to assess the problems of labor displacement in the Louisiana oyster industry. The researchers will determine the extent of employment of oyster fishermen and their families both inside and outside the fishery, ascertain the social networks and resources available for support, and estimating the capacity of local labor markets to assimilate displaced fishermen and their families.

Economic Opportunities Based on the Historical and Cultural Development of Traditional New Orleans Jazz in Coastal Louisiana

Joyce M. Jackson, LSU Department of Geography and Anthropology

Research on traditional New Orleans jazz rarely attempts to place the music within the framework of its rural and coastal communities. An investigation of the rural and coastal origins of jazz will help to fill a void in the literature and provide a basis for the expansion of cultural interpretation of this traditional music. The researcher's culturally oriented study of the rural and coastal influences of New Orleans jazz will be presented in a book and a jazz atlas.

NATURAL FISHERIES

Verification of the Utility of Immunological Assays to Identify and Quantify Gut Contents of Marine Predators

John W. Fleeger, LSU Department of Zoology & Physiology
Ronald Siebeling, LSU Department of Microbiology

To understand the structure of marine food webs, better techniques are needed to identify the nature of the prey consumed by marine animals. Visual analysis has proven inadequate because some aquatic animals consume detritus and algal materials, while others are able to chew food or remove the hard exoskeletons so that the tissue is not readily identifiable. Serologically based approaches, through the identification of antiserums, have been used to identify the origin of protein in the gut content of predators since the 1940s. In this study, serological reagents will be used to examine the interaction among predation, ingestion, and digestion in a model predator-prey system. Laboratory-grown harpacticoid copepods

(*Amphiascoides atopus*) are consumed by post-larval and juvenile shrimp and fish. The study will identify the proteins in the tissue of this copepod that are unique to it, and produce a harpacticoid-specific antiserum from it. The researchers will use the protein assays to determine the levels of protein in the guts of grass shrimp following feeding of known numbers of the copepod, determine the residence time of prey protein, and correlate gut protein levels with actual number of prey ingested.

Application of a New Technique (1) for Determination of Postlarval and Juvenile Fish Nursery Ground/Refugia Function of Offshore Oil and Gas Platforms; and (2) for Biochemical Resolution of Problematic Identification of Larval Anchovy Complex

Richard F. Shaw, LSU Coastal Fisheries Institute
Ronald J. Siebeling, LSU Department of Microbiology

Data secured during this study will be applied to the fundamental question of whether offshore oil and gas rigs simply attract and concentrate fish or directly enhance production by encouraging increased spawning and providing increased nursery ground habitat. This study, in conjunction with another project sponsored by the Minerals Management Service, LSU, and the Coastal Marine Institute, will document the habitat function of oil and gas rigs and the species that use the habitat. The Sea Grant portion of the project will address the questions of whether platforms elevate biomass or diversity as natural reef ecosystems do and whether the rig nursery ground/refugia habitat enhances existing populations.

Light trap technology, a relatively new method for sampling and learning about the early life stages of fish, will be used along with more conventional methods to gather basic biological information on reef fish at the oil and gas platforms. Biochemical blood analyses on adult anchovy species will be used to develop species-specific immunoassays to identify small specimens living on the platforms that have previously been difficult to identify.

Development of DNA-Based Assays for Plankton Sampling

Joseph E. Neigel and Darryl L. Felder, Biology Department,
University of Southwestern Louisiana

The study of marine zooplankton is limited by the fact that direct microscopic examination remains the only accurate method for identification and enumeration of zooplankton specimens. This project seeks to develop new methods for the detection and quantification of individual zooplankton species, based on the presence and abundance of characteristic DNA sequences in sample extracts. The investigation will focus on developing and testing methods to detect and quantify DNA from the planktonic larvae of three brachyuran crab species, *Sesarma reticulatum* (a marsh crab), *Menippe adina,* and *Menippe mercenaria* (two stone crab species). The researchers will use both laboratory-raised and field-collected zooplankton.

SEAFOOD PRODUCTS

Serological Examination of Clinical and Environmental *Vibrio vulnificus* Using Capsule and Lipopolysaccharide-Specific Antibody

Ronald J. Siebeling, LSU Department of Microbiology

When present in oysters eaten raw, *Vibrio vulnificus* represents a serious health threat to people with compromised immune systems and gastrointestinal disorders. Not all strains of *V. vulnificus* are virulent, however, so it is important not only to quickly detect the presence of this pathogen before raw oysters enter commerce, but to distinguish virulent from avirulent strains of *V. vulnificus.* This project will assess the geographical distribution of virulent and nonvirulent strains among a large sample of environmental isolates; determine the identifying characteristics that predict virulence or avirulence; and develop methods to assess the state of virulence or avirulence of the types of *V. vulnificus* that exist in the marine environment but have not been recovered or detected among known clinical strains.

A Process to Kill *Vibrio vulnificus* in Oysters

Paul LaRock, LSU Department of Oceanography and Coastal Sciences

The U.S. Food and Drug Administration is proposing a six-month ban on the harvesting of oysters for raw consumption during the warmer months of the year because of the presence of *V. vulnificus*, which causes illness or even death for people with compromised immune systems or gastrointestinal disorders. The loss of oyster sales will have a disastrous effect on Louisiana's oyster industry, and, thus, on the state's coastal economy. In this project, the researcher will determine the factors—such as salinity, nutrient availability, and cooling rate— that optimize the killing of *V. Vulnificus* by rapid chilling; assess the effect of chill-killing on *V. vulnificus* pathogens that have been ingested by oysters to ascertain that the experimental laboratory model is applicable to contaminated oysters; and determine the effect of chill-killing on indigenous oysters infected by *V. vulnificus* and begin to develop a processing protocol.

PROGRAM DEVELOPMENT

The vast size, biological richness, and multiple uses of Louisiana's coastal region frequently give rise to sudden problems or research opportunities that must be addressed quickly. These may include an environmental crisis, an unanticipated research discovery, or the chance to expand the applications of an existing project. Sea Grant development funds enable the program to provide beginning support for such opportunities that are out of phase with the beginning of the normal two-year proposal cycle. The ability to stimulate new research initiatives, respond to current issues, and extend the scope of ongoing work is one of Sea Grant's greatest strengths.

Other projects not included in Louisiana Sea Grant's core program are those that are part of special research initiatives generated by the National Sea Grant College Program. These address specific, national needs and may involve researchers from different Sea Grant programs working cooperatively on various aspects of the same problem.

Louisiana Sea Grant supports the projects listed below in addition to its core research program.

Cryopreservation of Gametes and Early Life Stages of Oysters for Hatchery Production

Terence R. Tiersch, LSU School of Forestry, Wildlife, and Fisheries

Computer-controlled freezing (cryopreservation) of gametes offers the opportunity for the genetic improvement of oyster stock in hatchery production.

Improved Disease Resistance in the American Oyster (*Crassostrea virginica*)

Richard Cooper, LSU Department of Veterinary Science

Bacterial and parasitic infections are devastating both cultured and wild populations of oysters, causing high rates of mortality or rendering oysters unsuitable for human consumption. This project is designed to produce oysters with an enhanced ability to fight disease, thus providing the struggling oyster industry with an important economic stimulus.

Biotransformation of Chitin to Chitosan

V.R. Srinivasan, LSU Department of Microbiology

Chitin is an abundant, naturally occurring resource without many industrial applications, but deacetylated chitin, or chitosan, can be made into a variety of value-added products. This project is designed to develop an economical and environmentally friendly process for converting chitin to chitosan.

Distribution of Naturally Occurring Radioactive Isotopes in a Louisiana Coastal Forested Wetland

J.W. Day, Jr., LSU Coastal Ecology Institute

The researcher will measure the distribution of naturally occurring radioactive isotopes in soils, vegetation, water, and fauna of a Louisiana freshwater forested wetland that receives treated sewage effluent. The presence of the isotopes presents an opportunity to date the rate of a number of ecological processes such as soil accretion and tree growth and to determine the role of effluent in concentrations of radioisotopes in natural systems.

Cellular and Molecular Applications to the Biological Control of Coastal Erosion

Timothy P. Croughan, Louisiana Agricultural Experiment Station

The value of planting vegetation to rebuild marshes is a potential alternative to the construction of expensive and often ineffective physical installations that control water movement and reduce soil loss. A vigorous marsh plant native to Louisiana has been identified as a suitable candidate for replanting, but for use in erosion control, the plant's seed production capabilities must be improved. The researchers will use biotechnology to clone the plant in order to produce and evaluate artificial seeds for widespread planting. They will also develop a method for transferring the technology used to the private sector.

MARINE EDUCATION

If Louisiana is to manage, use, and conserve its rich coastal resources wisely, its educational system must produce citizens who understand the functions and processes of the coastal and marine environment. Since 1975, Louisiana Sea Grant has been committed to the support of projects that encourage and improve marine education at all levels of the educational system.

Louisiana Undergraduate Research Opportunities Program

Charles A. Wilson, LSU Coastal Fisheries Institute and
Department of Oceanography & Coastal Sciences

The goal of this project is to increase the number of undergraduates pursuing marine science careers by encouraging and supporting undergraduate research activities. Students propose and carry out a research project related to a larger ongoing project conducted by faculty, and report the results. Since 1992, 15 projects have been funded. The postgraduate activities of UROP participants are followed to provide a basis for program evaluation.

Cross-Disciplinary Marine Education Resources

Lyle M. Soniat, LSU Office of Sea Grant Development

Science education must develop citizens with the scientific knowledge and process skills to make responsible decisions about public issues, especially those associated with the coastal and marine environment. Cross-disciplinary instruction integrates the elements of science with the elements of other disciplines, like sociology or economics, within the K-12 curriculum. In this project, science curricular materials previously developed by Sea Grant will be linked to state-adopted social studies, geography, and economics learning objectives. Teacher training workshops will assist teachers in learning to use the materials, which will combine interactive videos and print. Universal concepts will be applied to topics germane to Louisiana and the Gulf region in order to disseminate information about the functions and effects of science in the students' everyday worlds.

MARINE ADVISORY SERVICES

Louisiana Sea Grant's marine advisory projects serve the people by communicating the results of research through publications, educational programs, and practical assistance. Sea Grant advisory groups include the Communications Office, the Marine Extension Service, the Legal Advisory Service, and the Marine Recreation and Tourism Advisory Service.

Publications and Information Dissemination

Elizabeth B. Coleman, LSU Office of Sea Grant Development

The Communications Office disseminates the results of Sea Grant research as well as information on the complex issues involving marine resources, the marine and coastal environment, and new aquatic technology through a variety of products

and services. Publications, workshops, news releases, video tapes, classroom materials, posters, exhibits, and a quarterly research magazine are distributed to widely varying audiences, including scientists, fishermen, educators, legislators, marine advisory agents, and a large cross-section of people whose livelihoods depend in many ways on the coastal and marine environments.

Legal Advisory Service

Michael W. Wascom, Louisiana Sea Grant Legal Program

Each change in the law relative to ocean and coastal resource use, management, and conservation has some impact on Louisiana's coastal and marine environment. Through the analysis and interpretation of environmental legislation, the distribution of publications and briefs, and the coordination of seminars on coastal and maritime law, the legal staff serves a variety of audiences including commercial fishermen, seafood processors, coastal businesses, recreational groups, conservation groups, coastal landowners, state land managers, and regulatory agencies. This program also provides law students with training in the practical application of ocean and coastal law.

Advisory Services in Marine Recreation and Tourism

Michael M. Liffmann, LSU Office of Sea Grant Development

The development of commercial recreation and tourism in coastal Louisiana has presented significant opportunities for the stabilization and diversification of local coastal economies that were devastated by the economic and social consequences of industrial decline in the 1970s and early 1980s. For a decade, Sea Grant has worked with coastal community leaders to develop local recreation and tourism resources as a means of economic expansion. Since 1993, the emphasis has been on assistance to coastal recreation interests such as marina and charter boat operators, marine-related businesses, boaters and fishermen. In the next biennium, the project will address the impacts of environmental regulations on recreational management issues.

Marine Advisory Services in the Cooperative Extension Service

Kenneth J. Roberts, Louisiana Cooperative Extension Service, LSU Agricultural Center

Through the statewide network of the Cooperative Extension Service, 12 marine extension agents living in coastal parishes link the benefits of university research with Sea Grant's coastal audiences. Educational programs on such topics as aquaculture, natural fisheries management, seafood production and processing, coastal and wetlands management, consumer affairs, and community development touch almost every aspect of coastal economic life. Working through local and state advisory committees, community leaders, industry representatives, and local and state governments, marine extension agents identify problems and develop educational activities to address them. LSU-based specialists in wildlife, aquaculture, seafood technology, engineering, and wetland and coastal resources provide technical support for this field staff. (See pages 10 and 11 for a listing of extension agents and specialists.)

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