OYSTER DEPURATION IN MANAGED ON-SHORE FACILITIES IN MISSISSIPPI

Some Key Information on Facility Specifications,
Potential Economics and Operational Expenses

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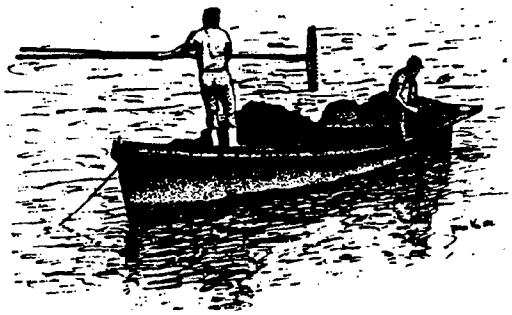

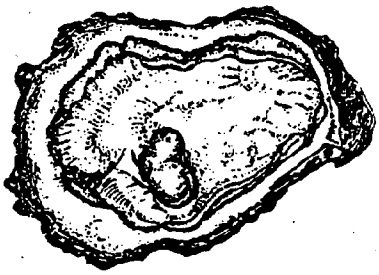

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INTRODUCTION

The word "depuration" has the dictionary meaning of purifying or cleansing. In discussing oysters and other shellfish it is commonly referred to as a procedure whereby disease-causing microorganisms are removed by purging. The shellfish are placed in clean water, that is, water free of disease-causing micoorganisms and indicator microorganisms. The latter are those which can be easily detected using analytical procedures and which potentially indicate the presence of disease-causing microbes. As the shellfish pump the clean water through their system, the undesirable and indicator microorganism are purged.

Oysters harvested from waters contaminated with pathogenic microorganisms can be technologically depurated by two procedures. First, oysters are harvested from "polluted" saltwaters and transported to specified natural open-water areas containing "clean" saltwater. They are then allowed to depurate for a minimum period of 15 days. Subsequently, they can be harvested and marketed. Numerous techniques have been used from deployment of cages, baskets, trays and other containers to simply placing the shellfish on the bottom.

The open-water depuration procedure is currently being employed on a very limited basis by the Bureau of Marine Resources and private lease holders in order to take advantage of the greater natural production in restricted waters

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where environmental conditions are more conducive to consistent oyster production and growth. Problems associated with this depuration procedure include: excessive mortalities, losses caused by the inability to find and recover significant amounts of relayed oysters, uncontrolled environmental conditions, predation, poaching problems and increased costs associated with having to harvest and transport the oysters twice (to and from the depuration site).

A second procedure involves harvest and transport of "polluted" oysters to an on-shore facility where they are washed to remove debris from their shells and then placed in tanks containing a specified volume of "clean" saltwater that is passed over the oysters at a specified flow rate. Temperature and water quality are carefully controlled and maintained. The microbial quality of the oysters is also monitored. The water is constantly recirculated. Critical to this procedure is the use of a disinfectant to destroy the microorganisms released from the oysters prior to the water being recirculated over the oysters. The oysters remain in the carefully managed system for a minimum of 48 hours after which they may be marketed.

This procedure would significantly reduce mortalities and costs associated with harvest and transport due to the fact that harvesting operations from natural waters would be conducted only once. Furthermore, there would be no loss due to non-recovery and the oysters can be depurated in 48 hours rather than 15 days.

Such on-shore depuration facilities are currently in operation in other countries, but most of the procedures used in these foreign countries do not meet the U.S. Food and Drug Administrations regulations and standards. The United States has such facilities, however they are currently limited to clams and other shellfish, not oysters.

Louisiana and Texas have recently drafted regulations which potentially would allow for on-shore depuration activities with oysters. Such facilities are currently being tested in Louisiana and Texas.

PROBLEMS TO BE ADDRESSED RELATIVE TO A DEPURATION FACILITY

Although the technology to depurate shellfish exists and has been in use for years, especially with clams, the application of such technology is currently not permitted for oyster depuration in the U.S. For the depuration procedure to be permitted from a regulatory viewpoint, oysters must be harvested from growing waters that are not considered to be laden with harmful industrial chemicals. It is important to note that oyster-growing waters in the State of Mississippi are generally free of such industrial pollutants. Therefore, with proper management and monitoring of the harvest and depuration process, oysters located in restricted waters of Mississippi which are polluted with undesirable microorganisms derived mainly from sewage and rainfall runoff, are prime candidates for depuration in Mississippi.

It is extremely important to realize that all regulations involving management, technology, enforcement and monitoring procedures must be approved by appropriate state and federal agencies before depurated oysters can be marketed from any depuration facility. The depuration facility must initially operate and prove its effectiveness and reliability through monitoring before a permit can be issued to allow for the routine depuration of oysters and their movement through the market system.

Another problem that must be addressed relative to such a facility involves legal barriers. Presently, neither Mississippi nor the federal government has regulations in place which will allow private operations or even the State of Mississippi to market oysters harvested from restricted waters and depurated in a controlled depuration facility. In fact, State law currently restricts all relaying operations to only privately leased grounds or to public reefs.

Legislation is needed to allow the operation and testing necessary to achieve approvability of a facility in Mississippi. In order to accomplish such testing, an agency needs to be designated with the responsibility and authorized to construct and operate a facility using available funding. Also, it will need to hire qualified competent people necessary to complete the tasks.

Additionally, the State, through some agency, needs legislative approval to permit the design of commercial systems and to monitor and certify depurated oysters once such a facility is operating successfully. This certification is needed to avoid lawsuits and high insurance premiums, and to instill public confidence for the consumption of Mississippi depurated oysters. This certification will enhance market opportunities for all of the Mississippi oyster resources.

A third problem or question involves the type of organizational/ operational structure for operation of such a facility(ies) and the funding needed. There are numerous options to resolve this issue. The following are some of the options:

A designated State agency would receive funding from whatever sources were available including but not limited to federal and private sources, to construct and begin operation, testing and evaluation of a pilot plant. Scientists and supporting personnel would test the system to provide the proven techniques and technology for FDA approval of depurated oysters. During this evaluation period the designated State agency would have complete control of operation, maintenance, testing and reporting.

Once the technology is proven and accepted by FDA, the State could assume a variety of roles:

(1) The State could continue to operate the facility and construct other commercial facilities while purchasing oysters from fishermen and selling the depurated oysters to processing plants. (This type of operation is similar to the way the State handles liquor.); or

(2) The State could continue the operation of the pilot plant for the purpose of conducting research on:(1) ways to improve depuration technology to meet improved FDA standards; (2) triploid oyster production; and (3) genetic selection of faster growing oysters. (NOTE: Importantly, triploid oysters grow faster than "wild" oysters and have the potential to be harvested during the very warm season. "Wild" oysters harvested during very warm weather have undesirable meat quality for commercial processing). Additionally, the State would encourage development of commercial facilities through technical assistance and would assume a monitoring, permitting and certification role while allowing private sources to develop state-of-the-art commercial depuration facilities. (This type of operation is similar to the way the State handles milk.)

In addition to technology transfer, the State would also be responsible for enforcement, shell planting, tagging of sacked oysters and other supervision as oysters from restricted areas are moved by fishermen, delivered to the private depuration plants, cleansed, processed and marketed.

OBJECTIVES OF AN ON-SHORE DEPURATION FACILITY

The State-managed oyster depuration facility would be operated with, at least, these objectives in mind:

(1) To actually depurate oysters from restricted waters for the purpose of enhancing commercial oyster harvest and utilization, and potentially for replacing production from offshore reefs which are dying from predation and increasing salinity;

(2) To produce an "in-house" income which covers the operational cost for depurating oysters while maintaining a competitive price with shell stock from "open public" reefs. This income would allow for the maintenance of an "in-house" experienced staff to provide technical assistance for development and operation of private commercial facilities;

(3) To demonstrate adequate depuration so that State and Federal regulatory agencies will allow such depurated oysters to enter interstate commerce;

(4) To provide State of Mississippi certification that oysters have been depurated according to certified conditions and meet certified quality thereby ameliorating insurance problems for processors receiving oysters;

(5) To provide jobs and incomes for oyster fishermen by allowing them to harvest from areas that have been closed for over 20 years;

(6) To provide an effective procedure for returning shell material from depurated/processed oysters to the growing waters in order to perpetuate production.

TYPES OF FACILITIES AND PARAMETERS FOR DEPURATION

The following have been identified as standards for depuration/treatment of oysters and although they have not been officially adopted they represent the state-of-the-art for present time:

Flow rate: 1 gal/min/bushel (0.626 sacks = 1 bushel)

Volume of Water: 59.84 gals/bushel.

Maximum depth of shellfish per tray: 3 inches.

Salinity: 10 ppt to 30 ppt.

Temperature: maintained to prevent spawning, 10°C - 25°C.

Bacteriological (total coliform/100 ml): 0 to less than 1.

Dissolved oxygen (mg/L): 5.0 to saturation.

Turbidity (Jackson Turbidity Units): 0 - 20 units.

pH: 7.0 - 8.4.

Minimum depuration time: 48 hours.

A variety of tank configurations have been employed with the objective of meeting the above parameters. Discussed herein is the employment of 100' long tanks (actual dimensions 101' L x 5' W x 4'D) which can hold up to three (3) trays each. If shorter tanks are desired, they can be utilized.

The size of a depuration facility is determined by the number of tanks one wishes to employ. For the comparison purposes we will discuss capacity, costs and other factors related to construction and operation of a commercial facility capable of depurating approximately 1,000 sacks of oysters per depuration cycle. (A depuration cycle equals 2.125 days)

CAPACITY:

Approximately six (6) 100' tanks would be required to depurate 1,000 sacks of oysters during one depuration cycle. Each tank would contain three (3) trays in which oysters would be arranged so as not to exceed a depth of 3 inches. The tanks would be located in a metal frame insulated building approximately 68' wide by 114' long. This space would allow for working room, but some additional space may be required for a biological filter system.

PRELIMINARY CONSTRUCTION COSTS:

Since no U.S. permitted full-scale commercial oyster depuration facilities are currently operating, costs for construction of such a facility must be calculated based upon a selected operational size and associated physical plant components.

We project a construction cost of $250,000 for the building (7,752 square feet) and depuration equipment, including the 6 (six) depuration tanks, each 100 feet long.

LABOR COSTS

Our prototype being discussed here would be computer monitored. Using computers we would provide for the greatest efficiency in operation while insuring that specified water parameters are continuously monitored, recorded and met throughout the depuration period. The following is a list of persons to be employed with the approximate costs per year of operation:

(1)	Manager	- $20,000
(2)	Electronics Technician	- $16,000
(3)	Plumber	- $15,000
(4)	Computer Operator	- $14,000
(5)	Other Labor	- $10,000
	Total labor costs per year	- $75,000

OPERATING AND MAINTENANCE COSTS:

These costs are perhaps the most difficult to determine. They should be significantly less than such costs for an office building since equivalent lighting and heating would not be required, except for a small office area. Direct heating of the water rather than the air in the building is being considered. Likewise the types of equipment and associated operations will probably cause the operation and maintenance costs to exceed that of a standard warehouse.

For the purposes of this paper we will consider that $50,000 would be more than adequate for maintenance of depuration activities, and it is highly likely that the costs would be one-half this figure since the facility will only operate in the depuration mode for approximately 7 months out of each year.

POTENTIAL PRODUCTION AND ECONOMIC IMPACT

Using the example of our facility having a capacity of 1,000 sacks per depuration cycle and an operation period of 6-7 months, a single facility could depurate 100,000 sacks of oysters per year. Based on present and immediate past assessments of production from Biloxi Bay, Pascagoula Bay and surrounding area, and the Bay of St. Louis area, it has been determined that each of these areas could produce the 100,000 sacks per year for depuration and, importantly, even more sacks in the future with an expanded base of material for oyster production.

If three (3) commercial facilities were operating, the annual oyster production would be 300,000 sacks irregardless of production from open public reefs. It is interesting to note that during the recent ten-year period, the reefs in the open off-shore waters produced only an average of 125,000 sacks of oysters per year. In fact, the highest recorded production from open waters during the recent 10 year period was 365,000 sacks in 1982-83.

Assuming an average purchase price of $12.00 per sack to fishermen, the dockside value of oysters harvested from restricted bay waters would be $3,600,000 per year. Using a conservative economic multiplier of five (5), the value generated by the three facilities once translated to the consumer would be $18,000,000 per year.

RECOVERY OF DEPURATION COSTS

Entrepreneurs in Texas have determined that depuration costs would equal approximately $2.50 per sack. This figure may be somewhat inflated based on the general calculations of the authors. For example, $2.50 per sack would generate

$250,000 for the operation, maintenance and other costs of a 100,000 sack per year facility. At this rate the original construction costs as well as ongoing costs would be recovered in two (2) years. Thereafter, the facility would generate approximately $100,000 per year in profits, or the funds could be utilized to meet objectives previously described for improving oyster quality and production.

Nevertheless, the $2.50 depuration fee could be collected by reducing the price paid to fishermen by $2.50/per sack from the "going rate" or by increasing the price to processors by the same amount. Fishermen contacted in Mississippi have indicated they would without reservation, take $2.50 less per sack if they could harvest oysters from one of the previously mentioned closed areas. They indicated that the increase in catch per amount of effort and the reduction in fishing time would compensate for the $2.50 per sack depuration fee and these factors were the prime reasons why they could accept less per sack. Processors have not been contacted, but the authors believe that they too would be willing to pay an additional $2.50 per sack for a guaranteed supply of certified, depurated oysters. If not, there is also the possibility of the depuration fee being shared in some combination by both the processor and harvestor.

MONITORING AND ENFORCEMENT

Assuming commercial oyster depuration systems will be allowed to operate in Mississippi to increase job opportunities and to enhance tax revenues, effective monitoring and enforcement will be vital factors to assure acceptability and continued success of such operations. For example, it is necessary to monitor oyster harvest from restricted waters, movement to the depuration plants and the depuration process. Effective enforcement of standards and regulations associated with oyster depuration activities is also necessary and critical to the success of the overall activities.

Before the monitoring and enforcement procedures can be formulated and applied, however, considerable planning, evaluation and coordination will be required. Other states in the Gulf Region have recently moved in this direction and their associated monitoring/enforcement activities will be much more complex than those which will be required for Mississippi. Their monitoring/enforcement activities are more complex because their oyster production in restricted waters covers vast areas whereas oyster production in Mississippi's restricted waters is, by comparion, confined to a relatively small geographic area. This confinement will make monitoring enforcement much easier in Mississippi relative to states like Louisiana, Texas and Florida. As a result, Mississippi's harvest from restricted waters and the associated depuration system should be more likely to receive approval from FDA.

Therefore, the monitoring/enforcement activities associated with depurating oysters should not be the limiting factor for implementing oyster depuration in Mississippi. This statement is true provided careful and innovative planning is conducted and monitoring/enforcement activities are carefully managed and coordinated to insure that all phases of operations involving the depuration of oysters harvested from restricted waters are effectively maintained. It is readily realized that developing and operating an effective enforcement program will require more intense efforts than developing and operating the technical aspects of the oyster depuration facility.

In summary, the authors believe that on-shore depuration of oysters is feasible and cost effective for Mississippi and that sufficient oyster resources exist in restricted bay waters to provide for a significant ongoing annual production of depurated oysters. This production is expected to be greater than the average annual harvest realized over the recent past ten (10) years from open public reefs (125,000 sacks). Furthermore, with legislative authorization, a pilot facility can be built to test and prove techniques to provide necessary

data for product acceptance by state and federal authorities and to improve the procedures. Finally, the oyster industry can be revitalized by management and cleansing of oyster resources from the Mississippi bays where successful oyster production can be predicted. These oysters can be rendered safe for human consumption through an effective program of reef management, enforcement, depuration and monitoring.

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