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# *Chapter 22*

# Managing Around Oyster Diseases in Maryland and Maryland Oyster Roundtable Strategies

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## *Abstract*

In response to declines in harvest and the widespread distribution of *Perkinsus marinus* (Dermo) the state of Maryland has engaged in the movement of oyster seed from moderate to low salinity areas. In 1993 an "Oyster Roundtable" was convened to develop recommendations for reviving oyster populations in the Maryland portion of Chesapeake Bay. Action items were developed concerning five general issues of oyster production and/or ecology: 1) management of diseases affecting oyster populations, 2) habitat and water quality, 3) production/management of the fishery, 4) institutional barriers, 5) funding. The concept of Oyster Recovery Areas (ORAs) was established. A review of the individual elements of the plan indicates that further consideration needs to be given to balancing issues related to spread of disease and persistence of reefs in low salinity areas.

[1]This article represents the author's interpretation of the Maryland Oyster Roundtable Action Plan and does not represent the views or interpretations of the group as a whole or any of its members except KTP.

# Introduction

*Perkinsus marinus* (Dermo) has been detected in all Maryland oyster bars surveyed in the last few years. The Department of Natural Resources Fisheries Division predicts that most of the one-year old oysters in the Maryland portion of the Bay will die during their second summer - just before reaching market size - from *Perkinsus marinus* infections. In order to prevent the total collapse of the fishery, the State initiated a seed movement program which transplants one year old oysters from moderate salinity areas, where they will be more likely to succumb to infections, to more brackish waters where a greater percentage will survive to market size and be harvested (Christmas and Jordan, 1988, Abbe, 1988, Krantz, 1992, Smith and Jordan, 1993). This program is responsible for most of the current production in the State.

A review of the literature, especially the work of Andrews and Ray (1988), reveals that specific management strategies dealing with *Perkinsus* have been developed and employed in many areas. Some strategies have been relatively successful, others have not, and success has been variable from region to region. The first and foremost recommended management practice is to utilize disease-free stocks. While the definition of "disease-free" remains controversial, the concept is clear: seed oysters with undetectable *P. marinus* infections are much more productive than oysters with even very light infections. Also recommended in the literature is the early harvest of infected beds followed by fallowing for a year to limit mortality and distribution of the disease in subsequent plantings. Finally, intensive monitoring of beds for disease is required to allow for specific management practices, such as early harvest, to be initiated at the appropriate times in the disease process.

The State seed transplantation program in Maryland is not based on the recommendations summarized above but rather on the observations that seed oysters infected with *P. marinus* survive much better in low salinity areas (<10ppt, Ragone and Burreson, 1990). The political realities of the management community require the State to provide harvestable oysters to maintain the public oyster industry. However, the practice, which usually transplants large amounts of diseased seed, brings many parastites into regions where they may not normally occur through natural transmission. In addition, this large-scale transfer is probably inadvertantly selecting for low salinity tolerant protozoans; indeed, low salinity tolerant *P. marinus* cultures have been produced in the laboratory. These strains have a much higher survival rate in low salinity than parasites raised at higher salinities (Burreson et al., 1994) . It is not yet known whether these low salinity parasites are as virulent as the higher salinity protozoans, but it would certainly seem wise to avoid accelerating the low salinity selection process.

Some intensive oyster culture ventures in Maryland have attempted to put the management recommendations of Andrews and Ray (1988) into practice (Paynter et al., 1992). The production of seed in the hatchery followed by nursery culture in low salinity areas has produced hundreds of thousands of seed oysters which have no detectable infections. Most of these oysters are annually transferred to higher salinities during their second year and reach market size before they succumb to *P. marinus* infections. Therefore, it would seem that previously established management strategies may be productive in Maryland's portion of Chesapeake Bay.

In 1993 the State of Maryland convened a group of 40 individuals who represented many groups concerned about the decline of the oyster resource in the Maryland portion of Chesapeake Bay. The members of this "roundtable" group consisted of fishermen, aquaculturists, environmentalists, legislators, academic scientists, and senior staff from the Maryland Departments of Natural Resources, Agriculture, Environment, and Governor's office. The goal of this roundtable was to develop sound, broadly-supported recommendations for reviving oyster populations in the Bay. Specific objectives were developed by the Roundtable to guide ensuing discussions and recommended actions. They included maximizing and enhancing the ecological benefits of oyster populations in the Bay, maximizing and enhancing the economic benefits derived from harvesting the public and private oyster grounds, and maximizing the ability of government to respond effectively to the magnitude of the problem. It was agreed that all recommendations of the Roundtable be made by concensus, therefore all action items had to be supported unanimously.

The Roundtable developed action items concerning five general issues of oyster production or ecology: 1) diseases affecting oyster populations, 2) habitat and water quality, 3) production/management, 4) institutional barriers, 5) funding. We also developed the concept of Oyster Recovery Areas (ORAs). These ORAs will be regions of the Bay in which shellfish harvesting and planting are restricted and carefully controlled. Within these areas two zones will be established: Zones A and B. Within Zone A all shellfish harvesting will be prohibited and only seed which has zero prevalence of *H. nelsoni* (MSX) and *P. marinus* (Dermo) will be allowed to be planted. In Zone B harvesting will be allowed but, as in Zone A, only parasite-free seed will be allowed to be planted. A Zone C was also defined but contained no restrictions on harvest or seed planting.

The strategies involved in developing these ORAs were varied but drawn from a few fundamental principles. The academic scientists argued strongly that the annual transplantation of *Perkinsus* infected seed into the upper tributaries of the Bay by the State repletion program was detrimental to the long-term recovery of oyster populations. In addition, environmental interests expressed the need for establishing oyster reef sanctuaries for both broodstock and ecological benefits. There was also significant interest in providing the opportunity for interested parties (aquaculturists and fishermen) to experiment with various forms of intensive oyster culture. Finally, there was an acute need for set-aside areas where research could be conducted without the uncontrolled influence of private and state activities including harvesting and seed planting. The establishment of the ORAs served many of these strategies and will be used as a vehicle for further resource rehabilitation and research.

The establishment of permanent or semipermanent oyster reef communities must incorporate sensible disease management practices including such destructive methods as total harvest to remove protozoan infestations. Only using sound scientifically-based management practices can the Chesapeake Bay oyster population be reestablished and maintained.

## Current Management

Current oyster management practices in Maryland are essentially directed towards the fishery rather than the resource. While the cull laws and gear restrictions which protect the size and number of oysters harvested, the bulk of the management activity has been dedicated to seed transplantation to augment the number of naturally occurring oysters in low salinity, low disease areas. Since the regions in Maryland's portion of the Chesapeake Bay which usually have heavy recruitment (ie. a good spatfall) are typically areas where Dermo prevalence and intensity is high, left alone most of each year's spatfall will succumb to the disease before attaining market size (Andrews, 1988). However, if the recruits are moved to lower salinities following their first winter, a much higher percentage of them reach market size. This seed transplanting or "repletion" program is generally thought to provide the bulk of each year's harvest.

While the repletion program has clearly contributed to the annual harvest and maintained, to some degree, the waterman's way of life, there may be several important drawbacks to the program. First and foremost, the current program, under which hundreds of thousands of seed oysters infected with dermo are moved to lower salinity areas sometimes many miles away, clearly transports millions of protozoans into low salinity areas where they would not normally have drifted or been carried after their hosts succumbed. Unfortunately, unlike MSX which is apparently killed by low salinity (Haskin and Ford, 1990; Ford, 1992), Dermo is not and can in fact continue to proliferate wihtin it's host even a low salinity (Ragone-Calvo and Burreson, 1994). Although the parasite does indeed remain within the oyster at low salinity, it's physiological impact on the host is apparently reduced allowing the oyster to reach market size and be harvested (Ragone and Burreson, 1990; Paynter and Burreson, 1991; Smith and Jordan, 1993).

As long as the bulk of the oysters transplanted remained alive and were removed by harvest, there would be no net contribution to the parasite burden in these areas. However, survival of these seed oysters to market size has been estimated at less than 50% (C. Judy, Maryland DNR, personal communication) indicating that a significant number of parasites are released into the ecosystem where they can infect other organisms. Furthermore, these infections would not be limited to oysters but would occur in other bivalves as well including *Macoma baltica* and the soft clam, *Mya arenaria* . Even if infections in other bivalves are not pathogenic, they represent a potentially large reservior of parasites which will serve to maintain infections in the local oyster populations.

Clearly, the transportation of large numbers of parasites into low salinity areas is not a productive activity. The value of the increased production of harvestable oysters should be weighed against the potential detrimental effects on the oyster populations in the long-term. Unfortunately, laboratory studies indicate that the parasite which causes dermo can regulate it's cell volume (O'Farrell, 1995). This means that it can control the effects of salinity change and could suggest that the parasite may become more virulent in lower salinities given enough time and selective pressure. A parasite which is more virulent in lower salinity waters would be devastating to the current industry in Maryland since the industry depends upon the survival of infected oysters in low salinity.

Growth and virulence data in floating tray studies suggest that production of seed in low salinity areas can result in relatively large oyster (1.5 to 2.5 inches) free from dermo infection (Paynter and Burreson, 1992; Paynter et al., 1992). When these seed are moved into higher salinity areas, their growth increases greatly and they can reach well beyond market size before MSX or Dermo kill them. Unfortunately, natural spatfall is rare in low salinity areas and in order to produce significant quantities of seed in low salinity areas, naturally caught seed would have to be relayed much earlier, probably within 8 to 10 weeks after settlement, to remove the seed before it became infected. This may not be feasible due to large mortalities in the young spat caused by transportation and handling. However, the concept has not yet been tested.

In summary, State activities associated with management of oysters in Maryland is focused on producing market size oysters for watermen to harvest. This involves the transportation of spat from southern regions of the Chesapeake where disease prevalences are high to northern, lower salinity areas where the spat will survive to market size. There is currently little State support for intensive ostraculture and many laws and regulations suppress it's development.

# Maryland Oyster Roundtable Action Plan

The Maryland Oyster Roundtable (MOR) Action Plan outlines a variety of recommended actions that should aid in the rehabilitation of the oyster populations. The action items will be reviewed and discussed in the order that they are presented in the MOR Action Plan document.

## I. Diseases

### 1) Monitor prevalence and intensity of MSX and Dermo in the Bay.

This action recomends a continuation of the annual disease survey conducted in October by the Maryland Department of Natural Resources (DNR) but also suggests that it continue on an enhanced level which will provide more information about disease intensities, prevalences, oyster sizes, and additional data analyses. The Cooperative Oxford Laboratory in Oxford, Maryland, has already begun this process by integrating the data with a computer-based geographic information system (GIS) which will allow greater access to not only the oyster disease data, but to relevant water quality data as well (Smith and Jordan, 1993).

2) **DNR management programs should minimize the possibility of spreading MSX and Dermo through the repletion program.**

Analysis of the seed transplanted from southern Maryland waters to low salinity upper Chesapeake Bay waters has shown that the oysters are typically infected with Dermo and many times with MSX as well. Infections of MSX are not considered to be a problem since MSX infections disappear in oysters transferred to salinities less than 10 ppt (Haskin and Ford, 1990; Ford, 1992) . However, Dermo has spread rapidly into the low salinity regions of the Bay in the last 10 years and recent laboratory investigations have shown that the protozoan which causes Dermo is quite capable of adapting to low salinities (Goggin et al., 1990; Ragone-Calvo, et al, 1994; O'Farrell, 1995). This makes *Perkinsus* a much more dangerous protozoan in terms of potential increases in low salnity oyster mortalities.

In order slow the rapid intensification of Dermo in low salinity areas, any management techniques which would serve to lower the prevalence and intensity of Dermo infections in the transferred seed would be valuable. Currently, the seed is moved in the Spring after the year it set which means that the seed is usually around 25 mm long and has likely acquired *Perkinsus* infections during the previous Fall. If the seed could be effectively moved prior to infection, then the State could accomplish it's goals of enhancing oyster productivity without adding to the parasite burden in low salinity areas.

3) **DNR and the University of Maryland, in conjunction with other regional especially neighboring State and Federal agancies, should implement a coordinated, multi-year, stabily funded, goal-oriented research program aimed at specific methods to identify, understand, prevent and control MSX and Dermo and other potential pathogens.**

This recommendation has obvious value in that it will provide information necessary for improving the survival and viability of the oysters in Chesapeake Bay. It will also enable managers to make better decisions with regard to the management of infected populations. The major thrust of this action item was to illustrate the need for stabily-funded, long-term research programs as compared to annually renewed, highly competitive, uncoordinated programs.

4) **Establish criteria and rationale for certifying oysters, including seed oysters, as having zero prevalence and intensity of MSX and Dermo (as well as any other pathogen which is found to significantly impact the oyster) at the time of planting as determined by current technology.**

This action item was established to enable a program of seed "certification" so that projects and programs in which "disease-free" seed are required will have a consistent benchmark and the State can establish an official measure of disease-free quality.

5) **Conduct an environmental impact assessment of the introduction of non-native species of oysters as a contingency.**

Recent proposals to introduce *Crassostrea gigas* into Chesapeake Bay have sparked much controversy regarding the importation of exotic species and the dangers inherent to those introductions (Burreson et al., 1990). The members of the Roundtable recognized the value of determining the resistance (or lack thereof) of other oyster species to MSX and Dermo and how well those species might perform in Chesapeake Bay (Allen, 1993). In light of the potential benfits of a resistant oyster to both the industry and ecology of the Bay, this action item was proposed to determine the potential impacts of non-native oyster introduction.

## II. Habitat/Water Quality

1) **Conduct a phased program to evaluate and implement projects to restore physical oyster habitat.**

There was general agreement that significant destruction of areas once conducive to oyster settlement and growth has occurred over the last several decades (see Hargis and Haven, 1988). It was agreed that a program should be initiated which would evaluate historic areas of oyster habitat, determine which areas have become unproductive, investigate the reasons for the failure of the area to remain productive and develop a plan or plans which will lead to the rehabilitation of the area to a productive oyster bar. These activities may include large scale construction and seeding programs, restriction of harvesting, and careful monitoring to determine the productivity of the area after rehabilitation. We do not know what will be the most productive methods and strategies to employ for rehabilitating oyster bars and therefore expect to test a variety of approaches.

2) **Ensure that Bay water quality is maintained at levels necessary to support healthy oyster populations.**

There was concern among the Roundtable members that degradation in water quality, especially in terms of sedimentation, is having a significant negative impact on the oyster population. This action item was included not only to acknowledge those concerns but also to make certain that the oyster recovery plan was as comprehensive as possible and that all of the important aspects of Chesapeake Bay ecology which might influence oysters were included in the ensuing research and management projects. Although there is little evidence in the scientific literature to support it (Chu and Hale, 1994), there is a also some fear that chemical pollution has injured the oyster population and the Roundtable sought to stimulate research in this area as well.

## III. Increase Production/Management

1) **Increase the hatchery production of oyster larvae and seed oysters**

Hatchery production of seed oysters and other bivalves has played an important role in the recovery of the major oyster producing areas in the world. The Pacific Northwest of the US, the Northeastern US and France have all employed large-scale hatchery production to augment natural production or to replace it altogether. There was general agreement, although certainly not a concensus, that hatcheries could and should play an important role in the rehabilitation of Chesapeake Bay oyster communities. In light of these beliefs, it was recommended that the University of Maryland hatchery at the Horn Point Laboratory and the State hatchery at

Piney Point be improved to increase larval and seed production at both facilities. These hatcheries will produce seed for rehabilitation and reconstruction efforts and provide a relatively low-cost seed for aquaculture ventures. The regional lack of high quality seed is considered one of the main constraints to the developement of private ostraculture in Maryland.

2) **Prepare a comprehensive analysis of past and current oyster culture techniques and managment approaches. Utilize existing expertise and experience in the National Marine Fisheries Service and elsewhere.**

As previously mentioned, several regions have experienced a complete collapse of the oyster industry. The Pacific Northwest, the Northeast, and France have all seen their oyster industries decline to essentially zero during this century. All have thriving industries at this date due to the changes in the industry that the collapses imposed. All three industries shifted from hunting/gathering/management techniques of natural production to more intensive large-scale farming activities where standard agricultural practices are utilized to maximize production and minimize problems including disease and predation. Having once been the single largest oyster producing area in the world, the Chesapeake Bay community can learn from the experience of the other areas which have recovered (Kennedy, 1989; Kennedy and Breisch, 1983). Therefore, it was recommended that a comprehensive analysis be conducted which will distill the most practical and productive activities that could be tested in the Chesapeake Bay.

3) **Maintain and adapt the current state repletion program.**

As mentioned earlier, there was significant concern among many of the members that the repletion program, in it's current form, continues to augment and exacerbate the disease problems in low and moderate salinity areas. Large numbers of infected oyster seed are transplanted annually from southern, higher salinity, high disease prevalent areas like Tangier Sound to low salinity regions in the upper Bay. In the low salinity areas the disease persists but does not intensify as rapidly. As a result, many more oysters reach market size than would if they were left in higher salinities. This practice was apparently borne out of a program which was dealing primarily with MSX. However, in contrast to MSX infections which are eliminated entirely when oysters are tranferred to low salininty, Dermo infection persist. Recent investigations have shown that the protozoan which causes Dermo, *Perkinsus marinus*, is capable of surviving very low salinities and that protozoans grown at low salinities tolerate even lower salinites much better than those from higher salinities (Ragone-Calvo, et al. 1994). Additionally, the protozoan also has the ability to regulate cell volume (O'Farrell, 1995). This means that continued inoculation of low salinity areas might result in a more virulent low salinity protozoan.

Regardless of the parasite transmission concerns, however, there was considerable support for the maintenance of the repletion program since it is thought to produce the bulk of the oysters harvested annually and watermen depend on additional income resulting from their participation in repletion activities.

4) **Provide fresh shell to be used by the state hatchery and for community groups for ecological enhancement.**

As mentioned previously habitat for oysters, clean shell, is thought to be greatly reduced in the Bay. Fresh shell is required for a variety of enhancement/rehabilitation efforts. It must be used to produce spat from the hatchery for planting on reconstructed bars. It is needed to build up areas which have sunken into mud or to place in areas where recruitment needs to be improved. This action item provides for the State to furnish fresh shell to the appropriate groups and communities which require it for such rehabilitation purposes.

5) **Evaluate the potential advantages and disadvantages of a "slot limit" with a minimum size of 2.5" and a maximum size of 4".**

To date there is little evidence that oyster populations in any region of the US have developed any resistance to Dermo. One hypothesis regarding the lack of this "natural selection" is that annual harvesting removes most of the resistant animals leaving the least resistant to contribute the most to the next years recruitment. If resistance can be developed in *C. virginica* a "slot limit" which would protect those resistant oysters from harvest might allow them to contribute more substantially to subsequent spawns and perhaps accelerate natural selection of resistant or tolerant populations. Populations of oysters resistant to MSX have been developed by Rutgers University (Ford and Haskin, 1987)

6) **Strengthen assessment of oyster stocks.**

The assessment of oyster stocks has recently been in question. Maryland officials claim that recent studies show that oyster abundance is relatively similar to abundances of 50 years ago (Homer and Jensen, 1995). There remains considerable skepticism regarding the interpretation of these results. They suggest that oyster abundance is not reduced but that the smaller oysters die from disease before they reach market size. Their contention is that disease is the primary cause of the reduction in the oyster harvest, not problems associated with recruitment or habitat. This action item calls for further analysis of natural stocks and oyster populations in the Maryland portion of the Bay.

7) **Encourage innovation by private industry by offering grants for the development of restoration, culture and production techniques.**

The State of Maryland has been notoriously hostile to the concept of private oyster culture in Chesapeake Bay (see Kennedy and Breisch, 1983, for review). Although some 2,500 acres of leased bottom are available for private oyster cultivation, they are largely held by families or communities which do not actively pursue oyster cultivation or are in poor growing areas. This action item is an attempt to stimulate the private sector rather than suppress it.

## IV. Institutional Barriers

1) **DNR should establish a pilot permitting program for oyster aquaculture demonstration projects.**

As mentioned above, the Roundtable sought to breakdown the barriers to aquaculture within the State. A pilot permitting program would allow individuals to legally attempt oyster culture and allow the State to learn how to best permit and control the developing industry.

2) **DNR should establish an aquaculture permit clearinghouse service for applicants.**

This action item was intended to remove many of the hurdles and barriers which currently confront anyone wishes to grow oysters in Maryland. These impediments seem small when a company is first starting up but can be critical if the appropriate permits are held up or not awarded. Costs resulting from permit delays can be very high.

3) **Define acreage available for leasing oyster bottom.**

Additional acreage needs to be set aside for leasing to private growers. Most of the current acreage is in poor growing areas and/or long held by families or communities who do not want to give them up. Further, many of the leased areas are in places which make them unprotectable. In order for private culture to succeed, the State must cooperate in providing access to growing areas that are practical, protectable, and in areas that are conducive to oyster culture. These kinds of areas often conflict with the interests of watermen who want to harvest clams in the areas. Many former oyster bars which are now unproductive and have been silted over are dredged for soft-shelled clams by the watermen.

4) **Compliance/enforcement and aquaculture projects**

Again, the State has never supported aquaculture in a fundamental way. This action item states that aquaculture should be given a fair chance and that respect of leased bottom, culture trays and other aspects of oyster culture should be strongly enforced.

## V. Research

1) **DNR and the University of Maryland, in conjunction with other State and Federal agencies, academic institutions and private research organizations, should initiate a multi-year, stably funded, goal-oriented research program on topics which will lead to the ability to detect, prevent and control MSX and Dermo.**

This action item was drawn up to encompass the scientific needs of the oyster rehabilitation effort. It emphasizes the needs of the research community to have a multi-year, stable set of funds from which to work. It also states that the research should be directed for the most part at the diseases which affect the Chesapeake populations. Finally, it strongly states that the State and other agencies, such as the University of Maryland, work together toward a common goal.

## VI. Oyster Recovery Areas

One of the initial Roundtable discussions centered around the concept of quarantine areas where both harvesting and planting would be highly regulated. Following the recommendations of Andrews and Ray (1988) large areas should be cleaned of disease-laden oysters, allowed to fallow for at least one year and then planted with uninfected stocks. These practices would be impossible in a public area where harvesting and planting were occurring annually. Furthermore, any aquaculture ventures would be seriously impeded by planting of infected seed within the vicinity of the cultured stocks and therefore a hindrance to any capital investment in moderate-scale oyster culture. In an effort to facilitate aquacultural experimentation and test the concept of establishing relatively dermo-free areas by planting only hatchery or uninfected natural seed, oyster recovery areas were developed.

Oyster recovery areas, or ORAs, were established with specific regulations and restrictions applicable within them. Three zones were established. Zone A was the most regulated zone where most, if not all, shellfishing (clams and oysters) was prohibited and planting of MSX- or Dermo-infected oyster seed was prohibited. In zone B shellfishing was allowed but planting of infected seed was prohibited. Zone C carried no restrictions beyond the standard state regulations but was established for possible future modification. The primary objective of these ORAs was to secure areas where moderate-scale aquaculture and rehabilitation pilot programs could be established.

Since Zone A areas within each ORA are strictly off limits to harvest, scientists, aquacultural entrepreneurs and environment groups could conduct a variety of studies including: the determination of how to efficiently produce oysters on a commercial scale, how to create or rebuild an oyster bar, how the benthic community might change with the establishment of a densely populated oyster bar or whether or not oysters from a hatchery become as quickly infected by *Perkinsus* as natural seed when they are planted on the bottom. Finally, in Zone A sanctuaries might be established to promote greater local recruitment in low salinity areas and be protected from rampant harvest. Oyster recovery areas were initially established in the Choptank, Chester Magothy, Nanticoke, Patuxent and Severn Rivers and are expected to be established in most subestuaries in Maryland. The Maryland Department of Natural Resources can provide an accurate description of the ORAs currently established and the geographical designations of the zones within them.

### VII. Oyster Recovery Partnership

The action plan also called for the establishment of a non-profit co-venture between all interested parties that would facilitate oyster recovery efforts, to implement many of the actions called for in the plan and to be a focal point for the programs established by the action plan. This partnership has been formed and is active in the pursuit of funding, participation, and cooperation in a variety of recovery projects.

## Summary

A vast amount of knowledge and experience exists in the historic record regarding oysters in Chesapeake Bay.

*The Chesapeake Bay and it's numerous salt-water tributaries contain prolific and valuable oyster beds.... The legislatures of Maryland and Virginia have, at every session for many years, revised and re-revised the laws upon this subject for their respective states; but have always been content to work in the dark, knowing nothing practically, and never seeing the value of obtaining full information upon so important an industry.*

*-E. Ingersoll, 1881*

*We have wasted our inheritance by improvidence and mismanagement and blind confidence; but even if our beds had held their own and were to-day as valuable as they were fifty years ago, this would be no just ground for satisfaction, in this age of progress, to a generation which has seen all other resources developed and improved.*

*-W. K. Brooks, 1891*

*In spite of the fact that less than half of the potential producing bottoms, one-half of those formerly productive, are now producing and only one-fifth as many oysters are now being produced, there has never been a single constructive forward looking attempt to rehabilitate the Bay. It has been conservation, and not altogether successful conservation as statistics show, and conservation only that seemed to dominate the policies of those in charge. Thus aiming at conservation and falling short of the mark has meant destruction of the oyster industry. Rehabilitation, alone, not conservation, can save the situation.*

*-Reginald V. Truitt, 1925*

The common thread in these quotations of well-respected biologists is that knowledge of the biology and ecology of the resource should be utilized to develop an intelligent management plan and, furthermore, that active *production* of oysters and oyster bars is more logical than intense removal of naturally occurring oysters and bars.

The Maryland Oyster Roundtable sought to incorporate the lessons and advice of the past, the theories and data of the present, and innovative approaches in the management not only of the fishery but also of the oyster resource in the Maryland portion of Chesapeake Bay. The Roundtable started by seeking to maintain the level of the present fishery and to begin to conduct research to determine the most productive and valuable ways to augment and facilitate the recovery of this ecologically important natural resource.

While oyster reef production or construction is thought to be an important and appropriate way to restore the natural resource, diseases in the Chesapeake Bay oyster population complicate the concept. However, agricultural management practices have been developed which help control and sometimes eliminate diseases from domesticated stocks. The same concepts can and should be applied to aquatic species. For instance, the issue of virluence and it's relationship to salinity needs to be considered when oyster reef construction or rehabilitation is planned. If an oyster reef is considered to be a long-term investment in benthic habitat production, then the survivorship of the planted oysters must be taken into account. If oyster reefs are planned in an area where disease pressure is high, then most oysters will likely die during the second year after planting. Unless the organization(s) planting the reef intend to reseed the reef every three to four years, the reef would have to be located in an area where annual natural recruitment was high. Similarly, in areas where disease pressure is very low, oysters may grow for many years but not have any appreciable recruitment, so additional seeding would need to be planned after a certain number of years depending on mortality rates in the area.

In general, following the recommended practices of Andrews and Ray (1988) will be a good starting point for reef rehabilitation. However, serious thought should be given to the appropriate management of the reef. For example, if and when it becomes infected, should the managers remove the infected animals to minimize the spread to new recruits? If so, how should the reef be harvested? If large organizations join together to create large tracts of oyster bar, what retrictions and regulations should be imposed? Should they be required to use disease-free seed? Should they be required to open the tracts for harvest when the oysters are market size or when they become infected? Will it be productive to create non-harvested reefs to enhance "natural selection" for disease-resistant animals? In general, these are the kinds of hard questions that need to be discussed when considering actively building oyster reefs.

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