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# Oyster fisheries management of Maryland's Chesapeake Bay

Diana Locke

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# OYSTER FISHERIES MANAGEMENT OF MARYLAND'S CHESAPEAKE BAY

by

Diana Locke

Dissertation Submitted in Partial Fulfillment of
the Requirement for the Degree of
Doctor of Philosophy
Administration/Management

Walden University
May 1998

DOCTOR OF PHILOSOPHY DISSERTATION

OF

DIANA LOCKE

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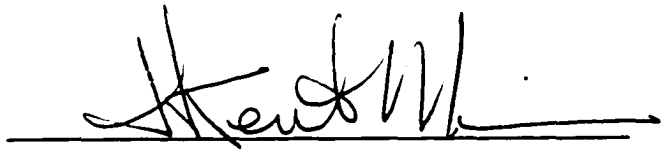

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Abstract

# OYSTER FISHERIES MANAGEMENT OF MARYLAND'S CHESAPEAKE BAY

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## ABSTRACT

This study examines the concept of property rights in relation to fisheries resource management in the Maryland oyster fishery. An analysis of the past and present state of this fishery on the Chesapeake Bay focused on the administrative, biological, social, economic, and political influences in fisheries management and their potential consequences. This single fishery once provided a quarter of America's oysters but, if the oyster population decline continues, it may soon become a memory. Though Maryland has a dual property rights structure, private and public, the public fishery predominates. The reasons why privatization has not been a successfully implemented strategy, and whether the Maryland fishery embodies a unique situation better served by other management strategies, were addressed, and community-based alternatives from other types of fisheries were evaluated for their efficacy and applicability to Maryland. Historical and current information on Chesapeake oyster populations, events contributing to population fluctuations, and changes in fisheries management strategies were examined for any causal trends and compared and contrasted with other fisheries. The study found that culture and job satisfaction prevents privatization from becoming an accepted property rights management strategy in Maryland. This study also illustrates how cooperative fisheries management strategies can address nonmonetary benefits, traditional values, and coastal community structures, while achieving a sustainable harvest, preserving a traditional way of life, and restoring habitat and the oyster's role in the Bay's ecology. Any changes in the future will likely be directed toward changing the rules of management and harvest for the public grounds. If oyster production is to be increased in the Chesapeake Bay, the cooperation, consent, and responsibility of the watermen are needed for any policy to be successfully implemented. The future of fisheries management will not and cannot be confined to fisheries biology and population counts. It will need to encompass a broad arena of disciplines working together toward a common goal.

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## Introduction

### Defining the Problem

#### Population Decline

Oysters are a symbol of the fabled productivity of the Chesapeake Bay, which was named by the Native Americans, and means *Great Shellfish Bay*. But these days the Great Shellfish Bay is far from living up to its former reputation. Questions are being raised about the future of the oyster fishery, the role of management in the declining harvest, and whether the brood stock is being lost. It is unknown whether oyster population declines occurred prior to keeping records of the harvest in the 1800s. However, what is known is that oyster harvests in the Bay are at historic lows (Jensen & Travelstead, 1992).

The Chesapeake Bay's celebrated oyster population has been ravaged by overfishing, disease, and pollution. This single fishery once provided a quarter of America's oysters but, if current trends continue, may soon become a memory, as may the skipjacks (Pollack, 1996; "So Do the Oysters," 1993). The decline of the oyster population has had a significant impact on the communities surrounding the Bay. It is becoming harder to make a living on the Bay, and young people are moving away from the communities that they grew up in. Though it is not unusual for fishers to seasonally fish different species, the harvesting pressure on the other species has increased to make up for losses in the oyster fishery, and now those other species are becoming depleted. Some watermen have even begun to work as guides for recreational parties of anglers when fishing is poor.

The oyster population in the Maryland portion of the Chesapeake Bay has declined by more than 50-fold since the early part of this century. The decline has been attributed to pollution, disease, loss of habitat, and overfishing ( Heral, Rothschild, & Goulletquer, 1990; Kennedy & Breisch, 1981). However, the decline in the oyster harvests began well before the

identified pollution problems or significant disease outbreaks. Heinle, D'Elia, Taft, Wilson, Cole-Jones, Caplins, and Cronin (1980) pointed out in a historical review of the Bay's water quality that it had started to deteriorate significantly since 1950 and that correlated with a significant increase in nutrients delivered in effluent to the Bay by run-off from farms and urbanized areas. Oyster diseases such as the protozoan parasites *Haplosporidium nelsoni* (MSX) and *Perkinsus marinus* (Dermo) were not reported until the 1950s to 1960s in the Chesapeake Bay (Rothschild, Ault, Goulletquer, & Heral, 1994).

Whether one believes that the reduced oyster harvests are caused by overharvesting or disease, there are compounding variables that both contribute to, and are the result of, these factors and lead to further decline. These include loss of habitat caused by excessive siltation and summertime low oxygen concentrations, reproductive failure of adults, or low larval recruitment and *spat* survival, and predation by numerous organisms from flatworms to crabs, fish, and waterfowl (Abbe, 1986; Kennedy & Breisch, 1981).

Beyond the loss of oysters and other Bay species that depend on the oyster reefs for habitat lies another threat, and that is the loss of a way of life that people have come to associate with the Chesapeake Bay. As the health of the Bay declines, the seafood that the Bay provided for centuries is lost, as will be the watermen that make their living from the Bay. As those things which make up the character of the Bay are lost, in a sense, the Chesapeake Bay itself is lost.

## Independent and Dependent Variables

Fishing gear and habitat destruction. The primary cause of the decline of the oyster population is overfishing (Goldsborough, 1993; NOAA, 1994). Loss of habitat is a dependent variable that is closely linked to fishing practices and is based on the biological life cycle and sessile nature of oysters. As the oyster fishery developed, the physical integrity of the oyster

reefs was damaged by oyster fishing gear. Hand tongs were the principal oyster fishing gear from the mid-1600s to 1865. Hand tongs are unlikely to have had much effect on oyster reef structure because watermen that are hand-tonging can only cover a very limited area per day and can only operate at depths no greater than 6 meters. Therefore, the extent of the area covered and the intensity of hand tonging is relatively limited (Rothschild et al., 1994). In addition, hand tongs have a relatively small effect on the reef substrate due to their limited mobility, their hand-operation, small size, and mechanical inefficiency.

The huge harvests that characterized the oyster fishery of the late 1800s, were possible due to a still abundant natural supply of oysters and to the introduction of large oyster dredges. Unfortunately, dredging is a destructive fishing practice. The legalization by the legislature of large oyster dredges in 1865 was the beginning of increasingly destructive fishing practices and of the subsequent decline of the fishery. However, initially the dredges made it possible to drag up from the reefs huge harvests of oysters. The dredges were dragged over large areas of oyster bottom, and as they were dragged over the bottom they removed and disassociated components of the reef reducing the profile of what once were tall reefs that jutted out of the water at low tide to much flatter oyster beds. In addition, the dredges could be operated in deeper waters than the hand tongs. The use of these dredges began to degrade the physical integrity of centuries old oyster shell accretions and the oyster reefs (DeAlteris, 1988; Winslow, 1881). By the late 1870s, over 700 vessels using dredge gear had contributed to increasing both the intensity of fishing and its areal extent.

Attempts to constrain total fishing effort by restricting the use of dredge gear to sail-powered vessels appears to have had limited effectiveness because the number of large sail-powered skipjacks had increased to greater than 1,000 by 1890 (Rothschild et al., 1994). Even as early as the turn of this century, the realization that the fishing effort was too great and that the

decline in catch reflected a decline in abundance was reinforced by the observation in 1900 by Grave (1907) that the dredges nearly exhausted the oyster beds before the end of the fishing season.

In 1887, the introduction of hand-operated patent-tongs enabled the harvesting of oysters in even deeper waters, extending the range and fishing efficiency of the oyster fleet to previously unfished deep-water beds. By 1950, hydraulic-powered patent tongs were introduced. These tongs are very destructive to the oyster bed substrate because of their capability to penetrate and disassociate the reef structure. This capability arises from their weight and hydraulic power. Hydraulic-powered patent tongs operate much like an industrial crane in that the tongs take a bite out of the oyster reef. In 1994, about 580 boats were operating with hydraulic patent tongs (Rothschild et al., 1994).

When Yates (1913) conducted his survey of the oyster beds in the Chesapeake Bay between 1907-1912, 25% of the Maryland portion of the Bay bottom was identified as natural oyster bed habitat. More recent surveys conducted by the Maryland Department of Natural Resources (DNR), including one from 1974-1982, have clearly shown a decrease in suitable oyster habitat. Analysis shows that oyster bed acreage declined by more than 50% from 1907 to 1982.

While local communities and watermen say they support the notion of habitat conservation, they also want increased oyster harvests. Scientists and fisheries managers usually recommend that fishing effort be decreased in terms of type of gear and total harvest to allow oyster beds to become repopulated with legal sized oysters and also to increase the size of the spawning stock. However, this goes against what the community and what the watermen want because it translates into lower employment and wealth (MacKenzie, 1989). Local people and watermen expect that scientists will cure their economic problems and that Mother Nature will

miraculously come through in spite of the unchecked destruction and overharvesting of the beds.

Siltation and sedimentation. In addition to the substantial decline in substrate area upon which young oysters can grow, the quality of the existing substrate has also been affected. The reduced profile of oyster reefs modifies the water flow near the oysters and can increase the deposition of silt on the bed. In general, mature well developed oyster beds with a high profile are associated with relatively intense current flows (Lam & Wang, 1990), which provide conditions favorable for increased growth and survivorship. Relatively intense flow may mitigate the negative effects of siltation and biodeposition, and increase consumption rates.

Oysters exposed to sediments have decreased growth and reproductive efficiency, while mortality and disease susceptibility increase. Siltation also reduces the quality and quantity of suitable habitat for spat settlement (Rothschild et al., 1994).

Over 100 years of increasingly intensive and mechanized fishing has contributed to leveling the profile of the oyster reefs in the Chesapeake Bay. Now, the formerly productive areas are so covered with silt that as a result, they are not capable of producing oysters, and those remaining unsilted areas are considerably less productive than in the past. The overfishing of the oyster stocks and destruction of oyster habitat by different types of fishing gear are considered by many to be more important factors in causing the decline of the oyster fishery than either pollution or disease, particularly since degraded habitat and susceptibility to parasitism may be correlated.

Disease. In the Chesapeake Bay, disease has been putting the last nail into the coffin of an oyster population already weakened by a century of overharvesting, elevated pollution levels, and habitat destruction. The disease versus overharvesting debate is continually confused by

context. However, there is no doubt that, historically, overharvesting has been the primary reason for the decline of the oyster fishery. Similarly, there is little disagreement that disease currently dominates oyster mortality (Goldsborough, 1993; NOAA, 1994). At the turn of the century, fishing pressure far exceeded sustainable levels. However, subsequent habitat loss, predation, and disease have prevented populations from rebounding. The pathogens MSX and Dermo were first described in 1907 and 1914, respectively (Mackin, Owen & Collier, 1950; Wood & Andrews, 1962). Both diseases are deadly to oysters but harmless to humans. The parasites that cause both these diseases are single-celled protozoans and should not be confused with the organisms that cause paralytic shellfish poisoning (PSP), which is extremely harmful, and sometimes deadly to humans and affects a wide variety of shellfish species. Though PSP has sometimes found its way into the Chesapeake Bay, the incidence is rare, low, and localized.

Dermo was first reported as a lethal oyster pathogen in the Virginia waters of the Chesapeake Bay in 1954. MSX was later recognized in moribund and dead Chesapeake Bay oysters in 1957 (Leffler, 1993). These protozoan parasites affect the abundance of market size oysters (3 inches and larger) by attacking and killing oysters before they reach 3 inches. Dermo tends to have its largest impact on oyster populations just as, or just before they reach market size while MSX does more damage to young or smaller oysters. Mortality generally occurs between 1½ and 2½ inches in size. Whereas populations of oysters unaffected by the parasites contain all sizes and ages, affected populations consist of oysters predominantly less than two years of age, with the exception of the occasional older oyster that survives the parasites' attacks (Jensen & Travelstead, 1992). Consequently, the bulk of the oyster population in the parasite affected areas (over 70% of the oyster grounds in Maryland, 90% in Virginia) are composed of oysters of less than 3 inches.

Oysters mature and begin spawning at approximately one year and when their length is

around 1¼ inches. Therefore, the brood stock is affected by overharvesting and disease simultaneously.

The two strongest factors affecting the prevalence of these oyster diseases appear to be temperature and salinity. While little is known about the parasite MSX, what is known is that it thrives in higher salinities and increases in prevalence in years of drought. The ability of Dermo to tolerate lower salinities makes it more persistent and damaging to oyster populations than MSX. Even though Dermo was first detected in the Bay in the 1950s, only within the last 10 years has its virulence so devastated oyster beds throughout the Bay. It has overtaken MSX, which has caused mortalities in Virginia's high salinity waters since 1957. Unlike MSX, which seems to lose its virulence in water salinities under 15 parts per thousand, Dermo has proved considerably more adaptable and can kill oysters in salinities as low as 3 parts per thousand (Leffler, 1993).

The startling decline of Bay oysters and the commercial fishery that depends upon them, coupled with the increasing recognition that the loss of oysters contributes to the deteriorating water quality, has become a catalyst for increased funding for oyster research. There are no known cures for MSX or Dermo though there is a substantial amount of research being conducted in state and university laboratories on developing disease resistant strains of the Eastern oyster. In 1993 a major breakthrough gave scientists their first effective tool to help counter Dermo. That breakthrough, developed independently and simultaneously in three separate laboratories, was the ability to culture Dermo in the lab (Leffler, 1993). Being able to culture the protozoan opened the door to studying its life cycle, infection mechanisms, and interactions with the oyster.

The only strategy presently available for protecting oysters from disease is to move the young seed oysters to areas where the disease is less virulent. These areas are in the less saline

reaches of tributaries and the upper Chesapeake Bay. Growth of seed oysters is slower in the upper Bay than in the traditional lower Bay harvest areas, but low salinities suppress the virulence of the diseases and allow many of the oysters to grow to market size. The ability of this strategy to maintain harvests or populations is dependent on the availability of large quantities of seed oysters. It is important to note that low salinity areas rarely produce a good natural set of young oysters, so without supplements of seed provided by the state repletion programs, these areas cannot produce continuing harvests.

Pollution and excess nutrients. Another contributing factor to the decline of the oyster fishery is pollution. Pollution in the Bay is usually one of two types, from chemicals that are generally considered toxic such as industrial effluents, or from excess inorganic nutrients from sewage treatment plants and overuse of fertilizers on suburban lawns and rural farms (Leffler, 1997).

Excess nutrients in the Chesapeake Bay are of particular concern because the Bay is relatively enclosed so these nutrients are retained rather than diluted out and stimulate excess phytoplankton growth. This phytoplankton becomes so dense that it blocks light from reaching the bottom of the Bay and hence chokes out the native benthic plants such as eel grass. In addition, excess phytoplankton eventually sinks to the bottom waters where microbial degradation and decomposition take place. As these deep bottom waters have little oxygen input such active bacterial respiration depletes what little oxygen is present. Consequently, the water in the deep channels turns anoxic and contains hydrogen sulfide, a toxic chemical which is the end product of bacterial decomposition. Sessile benthic invertebrates such as oysters and mussels cannot survive such adverse conditions (Chew, 1993).

Oyster population decline and excess phytoplankton growth are interdependent factors

contributing to the decline of the fishery because bivalve molluscs such as the oyster are active suspension-feeders that derive their food by filtering phytoplankton from the water column. The decline in the oyster population has reduced the amount of phytoplankton consumed by oyster stocks (Jonas & Tuttle, 1991; Ulanowicz & Tuttle, 1992). The phytoplankton, no longer consumed by the oysters, is partially responsible for the degradation in water quality, compounding the problems associated with increased nutrient inputs, and stimulating more phytoplankton production.

## Purpose of Study

The area of fisheries resources is fertile ground for opportunities to change the existing business-as-usual management environment. The challenge of creating a new way of doing business, a new way of managing, is intrinsically motivating to fisheries managers and other stakeholders alike. Routines, on the other hand, are comfortable, no matter how inappropriate or self-defeating, and can be the enemies of change (Bennis, 1989). As in most highly political, extremely hierarchical, and bureaucratic organizations and systems cloaked in age old traditions, fisheries resource management is highly resistant to change. Even the most well-intended managers often become victims of the vast, amorphous, unwitting, and unconscious conspiracy to prevent them from doing anything whatever to change the status quo.

If any organization, and in this case fisheries, is to make progress, then fisheries managers must be able to detect when routines or practices are becoming dysfunctional, if not outright destructive. Managers must be able to see when routines are smothering creative planning and blocking necessary change.

The purpose of this study was to examine the concept of property rights in relation to fisheries resource management in the Maryland oyster fishery. To achieve this, an analysis of

the past and current state of the Maryland oyster fishery in the Chesapeake Bay was conducted. There are in essence two oyster fisheries in Maryland: the public fishery, managed and subsidized by the state; and the private fishery, which operates on ground leased from the state and must abide by regulations set by the State.

The Maryland public oyster fishery is classified as a limited-access fishery. Different property rights management strategies can be used to achieve limited access with the intent to conserve and sustain the fishery. The strategies that have been used in the Maryland oyster fisheries, and their success or failure, are what are of interest. In the face of what is undeniably a catastrophic decline in the oyster fishery of the Chesapeake Bay, it was important to understand what led to the current state of the fishery and examine, compare, and contrast the contributing factors. In particular, the social, political, and economic influences that affect the leasing of Bay bottom for the private cultivation of oysters versus the prevailing attitudes within the public fishery are as important, if not more important, than the biological factors that have contributed to the decline of the fishery.

In other fisheries, both finfish and shellfish, as well as oyster fisheries in other parts of the United States, it has been shown that private cultivation is a highly successful property rights management strategy that has, in many cases, resurrected a declining if not failed fishery. Why then, have there been so many barriers that have discouraged leasing in the Chesapeake Bay, and in particular in Maryland? Why has the public fishery been managed and administered with virtually the same types of limited-access strategies for the past 100 years in the face of continuing oyster population declines?

Part of addressing the purpose of the study, to examine the concept of property rights in the Maryland oyster fishery, was to answer these questions and to examine whether the private fishery, in its limited capacity, has been or can be a viable fisheries management strategy.

## Research Questions

1. Can a single property rights management scheme be suitable for all oyster fisheries?

2. What social influences have hindered the acceptance of private cultivation of oysters in Maryland?

3. How have past and present oyster fishery regulations encouraged or discouraged private cultivation of oysters in Maryland?

4. Has the economic burden of private cultivation, alone, deterred increased cultivation of oysters or are other factors at work?

5. Do nonmonetary, intangible benefits provide watermen (sic) with sufficient compensation for the monetary loss incurred by working in the oyster fishery?

## Overview

### The Chesapeake Bay

The Chesapeake Bay, one of the world's most fertile, food-bearing estuaries, is located on the mid-Atlantic Coast of the United States and is fringed on either side by tidewater Maryland and Virginia, ending at Norfolk, Virginia on the south and Havre de Grace, Maryland on the north (See Figure 1). Although the Bay is commonly described as 195 miles long and from 4 to 30 miles wide, it is in fact a system about 20 times that size (See Figure 2). Nearly 50 significant rivers and thousands of streams and creeks penetrate deep into the surrounding land to form what is known as the Chesapeake drainage basin, or watershed, that spans an area northward to Cooperstown, New York, site of the Baseball Hall of Fame, as far west as Pendleton County, West Virginia, southward in Virginia to Lynchburg and Virginia Beach, and eastward to Seaford, Delaware and Scranton, Pennsylvania (Horton & Eichbaum, 1991).

More than 300 years ago, when European explorers first arrived in the Chesapeake Bay,

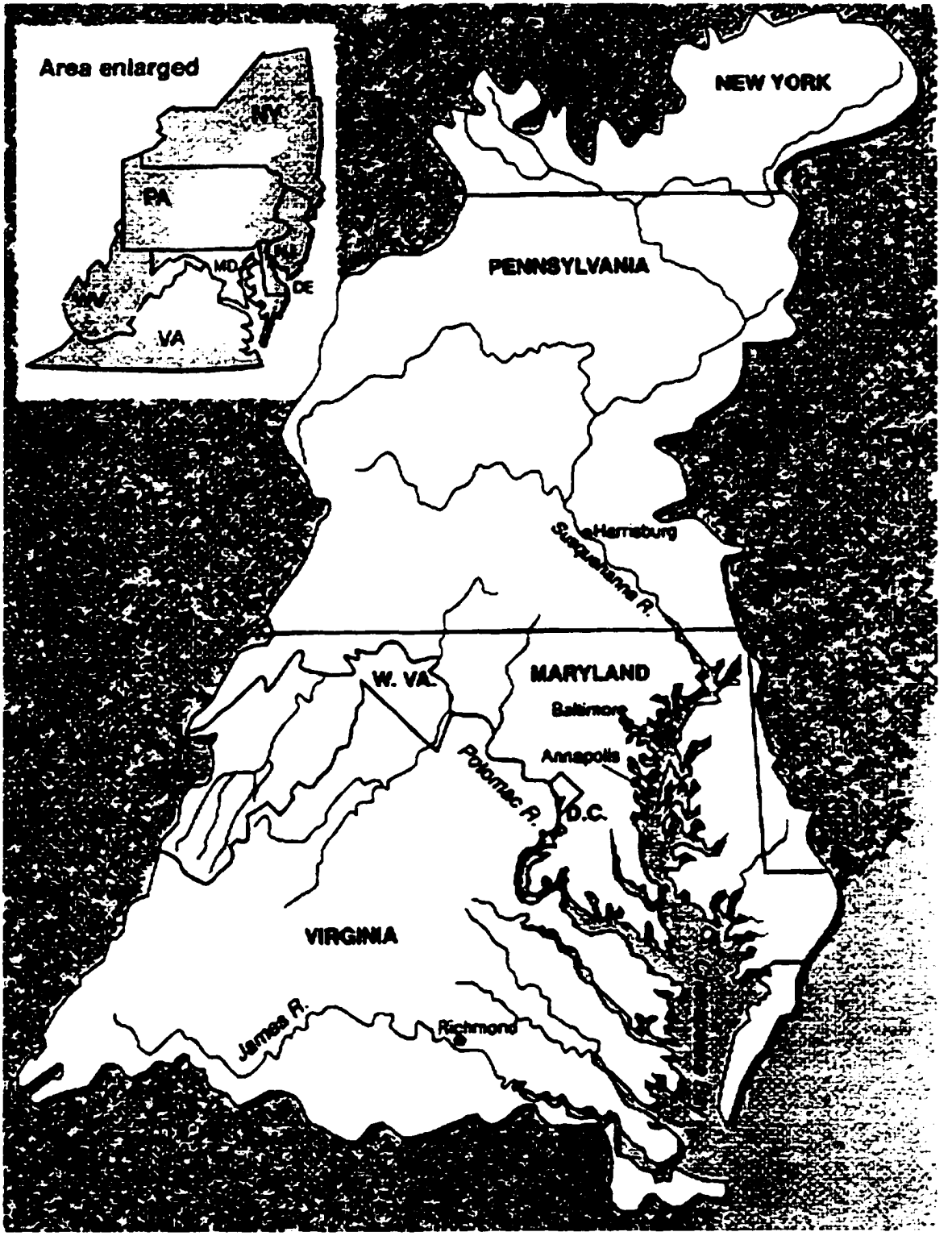


Figure 1. The Chesapeake Bay Watershed. Adapted from United States Environmental Protection Agency. (1983). Chesapeake Bay: A Profile in Environmental Change. Washington, DC: U.S. Government Printing Office.

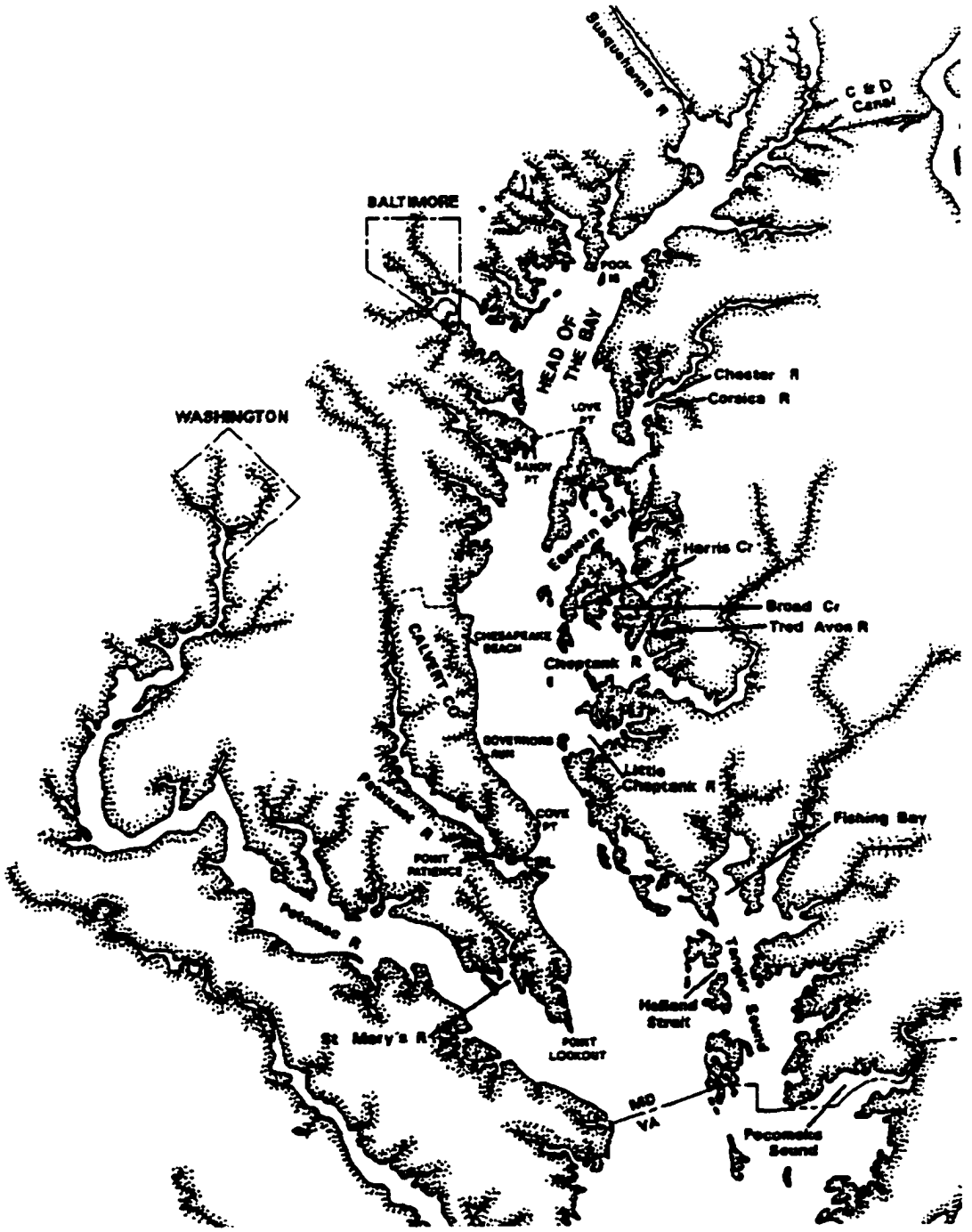


Figure 2. Maryland's Chesapeake Bay. Adapted from V. S. Kennedy & L. L. Breisch. 1981, Maryland's Oysters: Research and Management (Publication # UM-SG-TS-81-04) (p. 112). College Park, MD: Maryland Sea Grant College Publication.

oysters were so abundant and grew in such deep vertical reefs, as coral does, that they posed a navigational hazard for ships. Undoubtedly introduced to the delicacy by the Native Americans, settlers soon began to harvest the species in earnest. By 1874, 14 million bushels were being shipped across the country and across the sea. At one time, the larger reefs were tall enough to protrude out of the water at low tide. However, after the Civil War, relentless harvesting resulted in the flattening and loss of these reefs with the annual oyster harvest averaging 20 million bushels and today's harvests at less than 1% of the 20 million bushel peak (Abbe, 1992). In retrospect, it is clear that the huge oyster harvests taken during the late 19th century were not sustainable. Rather they simply represented a short-term mining of the wealth accrued on the Bay's bottom.

The Eastern Oyster

The Eastern oyster, *Crassostrea virginica* (classified by Gmelin, 1791), or as it is more commonly known, the Chesapeake, American, Malpeque, or Atlantic oyster, grows on shallow bottoms and inhabits Gulf and Atlantic Coast estuaries as far north as the Gulf of St. Lawrence and south to Key Biscayne, Florida. The Eastern oyster is frequently found where salinities range from 5 to 30%, provided other requirements are met including, but not limited to, a solid substrate, good water movement, temperatures between 0° and 32° C and an adequate food supply (Galtsoff, 1964). Since the 1880s, the Eastern oyster has been the basis for the most valuable commercial fishery in the Chesapeake Bay.

Before one can begin to understand the problems associated with managing an oyster fishery, one needs to have a rudimentary understanding of the biology of the oyster. Eastern oysters generally spawn from May through September in the Chesapeake Bay. Increases in water temperature to 18-20° C stimulates spawning activity. Eggs hatch into free-swimming *larvae* that

settle to the bottom two to three weeks after hatching. They attach to oyster shells or other hard substrate. This attachment phase is called *setting*. The newly attached oysters are called *spat*. Oysters generally grow at a rate of about 1 inch per year and growth rates can be affected by temperature, food quantity, salinity and parasitic infection. Shell growth usually occurs in the spring and soft body tissue growth occurs after spawning. Oysters usually reach market size (3 inches across) 3 to 5 years after spat settlement (Kennedy, Newell & Eble, 1996).

Oysters have a unique ecological role in the estuarine environment. As a result of their reproduction, growth, and tremendous filtering capacity, the oyster reef community is radically different from surrounding sand and mud communities. Oysters draw water into their bodies through a siphon, separate needed food particles from debris, and expel the waste water and particulates through another siphon. The oyster reef provides not only crucial foundation for oyster spat, but also substrate for other organisms such as barnacles, mussels, hydroids, nudibranchs, and algae. These communities in turn furnish habitat and life support to the commercially valuable Chesapeake blue crabs and finfish such as croaker, striped bass (known locally as Rockfish), white perch, and trout. For example, over 90% of the Atlantic Coast population of striped bass begin their lives in the Chesapeake Bay (Horton & Eichbaum, 1991). Striped bass depend upon the Bay for spawning and nursing grounds.

Another unique ecological role that oysters play in the Chesapeake Bay is as the Bay's water filters, removing dirt, algae, and other particles from the water and depositing it as compacted fecal matter on the Bay bottom. However, today's oysters live at lower depths, where silt and toxins settle and oxygen and food are in short supply. In these less than ideal conditions, the oysters are weakened and more susceptible to disease. For fisheries scientists, the Eastern oyster in the Chesapeake Bay is an indicator species of the health of the Bay. When the oyster population is sick and in decline, so is the entire Bay, so oysters serve as a biological sentinel.

As recently as early this century the billions of Eastern oysters living in the Bay could filter the entire body of water in 3 to 6 days. Today's much smaller oyster population is estimated to need about a year to do the same job (Gibson, 1995).

The Maryland Oyster Fishery

During the past century, the history of the Maryland oyster fishery has experienced a roller coaster ride of booms, slumps, and partial recoveries. Harvests that averaged more than 10 million bushels a year during the late 19th century have averaged 2-3 million bushels a year during this century. Even at those levels, the oyster fishery helps support around 4,000 watermen who dredge and tong oysters out of the northern Bay from early autumn through late winter (Kennedy & Breisch, 1981). The watermen's work is part of a larger commercial industry that includes not only dockside sales but stimulates the State's economy through shucking, packing, shipping, and marketing.

Presently, hand tongers, patent tongers, and dredgers take oysters off nearly 1,000 publicly (state) owned oyster beds spread over 215,000 underwater acres (Kennedy & Breisch, 1981). Most watermen work as hand tongers, using long, low-sided workboats with a small cabin forward and an open cockpit aft for dumping and culling each day's catch. The watermen spend their days at hard, physical labor, anchored over oyster bars where they dislodge and pull oysters up from the bottom with long, wooden-shafted tongs tipped with metal rakes. A growing number of watermen have equipped their boats with patent-tonging rigs that feature power-driven winches and some watermen have taken to hiring scuba divers. Only a handful of watermen still sail their skipjacks. These wide-beamed, sloop-rigged sailboats, unique to the Chesapeake Bay and a symbol of its past, are the last survivors of a commercial sailing fleet that once numbered in the hundreds. As of 1996 there were less than 12 left (Meyer, 1996a, 1996b). The sailing

fleet of skipjacks in Maryland is the last all-sail fleet of commercial craft operating in North American waters (Kennedy, 1989).

Over 30 years ago, the Maryland oyster fishery began changing from a hunter-gatherer fishery in which the watermen sought out and harvested only wild, naturally set oysters controlled only by natural cycles to a put-and-take harvest dependent in large part on human efforts (state funded) to replenish the oyster supply. Maryland taxpayers not living in counties that bound the Chesapeake often refer to the state funded Repletion Program as watermen's welfare or subsidies. On the public (state-owned) oyster beds, state fisheries management officials organize a major seed and shell planting program each spring on selected beds in an effort to offset erratic natural sets of new oysters (Kennedy & Breisch, 1981). The selection of which oyster beds in which counties are to be seeded each year is a combination of science and politics and, therefore, is not always conducted in the most optimal way. On private oyster beds some watermen lease Bay bottom from the state and plant seed and cultch to farm their own oysters.

For the Maryland oyster fishery, nearly all change stirs controversy and reactions tend to be extreme, fueled by politics and misinformation. When harvests decline, when watermen hire scuba divers, when fisheries resource managers alter seeding plans, when oyster leasing increases, then watermen, scientists, and fishery managers begin arguing about the causes and effects, the costs and benefits of change, and who will profit from the change. The history of the Maryland oyster fishery has been one with a record of abundance and decline, of evolution and of controversy, increased research, and increased management efforts to address the declines and maintain the fishery. It is fortunate that the Eastern oyster is a resilient species and the Chesapeake Bay, a resilient ecosystem, for the management of the Chesapeake oyster fishery has resulted in overfishing, poor conservation, and environmental degradation, and the oyster

population would have been wiped out long ago were it not for this resilience.

## Background

### Oyster Fisheries Management-Historical Overview

To both the scientist and the waterman, the oyster is the indicator species that reflects the health and vitality of the Bay. The Eastern oyster is such a resilient species that any threat to the survival of the oyster is an indication that the entire Chesapeake Bay ecosystem is threatened. The oyster is part of a complex Bay ecosystem, and a decline in the oyster population represents a loss of the vitality, resiliency, and productivity for the whole Bay. The management of the oyster fishery raises a complex set of issues to deal with including habitat, harvest, disease, and the introduction of non-native species. In addition, the continued inability to reach a broad consensus on how to manage the oyster fishery is an indicator that all is not well with the overall scheme of cooperation that lies at the heart of any effort to restore the Bay and its resources.

The stakeholders in the oyster fishery are as diverse as they can be, as are the three main reasons for wanting to restore the fishery (Matuszeski, 1992):

1. To provide for the commercial harvest of a valuable but much depleted species.
2. To protect a highly valued traditional way of life on the Bay.
3. To restore the oyster's role in the Bay's ecology.

However, for a variety of reasons, most fisheries management strategies focus almost exclusively on the commercial aspect of the oyster fishery. By most if not all accounts, the commercial harvest of oysters in the Bay continues to be characterized as an industry on the brink of collapse. Whether from overharvesting, disease, or both, the fact is that there are few harvestable natural reefs remaining. Many steps have been taken by state fishery managers to stabilize the oyster harvest through reseeding, relocation of seed, reef construction, and

sanctuaries, to name a few. All of them have been controversial and have for the most part been characterized as subsidies or watermen's welfare (Matuszeski, 1992). The efforts appear to be more focused on surviving another year without a major decline in the oyster harvest rather than on long-term remediation.

The preservation of a traditional way of life on the Bay and a symbol of the Chesapeake's legacy, watermen tonging for oysters, has not been given much direct attention when considering solutions to the oyster population decline. However, it is indeed responsible for much of the political and financial capital that is expended on the oysters. A relatively small number of watermen in the oyster fishery (compared to other professions such as teachers or lawyers) wield an incredible amount of clout in the legislative and executive chambers of the Maryland legislature. This tremendous influence lies not in their numbers but in the broad public support they enlist around the Bay and the inland parts of the state for protecting and even encouraging a lifestyle associated with self-reliance, physical challenge, and the uncertainties of nature.

Even if alternative employment were available outside the fishery or as hired labor for other fishers, owning one's own boat and gear gives the waterman a sense of independence not available in alternative employments. Evidence of the existence of these nonmonetary benefits can be inferred by the reluctance of the watermen to leave the oyster fishery even when it is no longer financially beneficial to stay (Santopietro, 1986). Eighty-eight percent of the watermen have lived in their present communities for 20 years or more, and most of the watermen live in homes in communities bordering the water, so that they are near the grounds they harvest, or have harvested.

Since 1820, when the first law was passed in Maryland relating to the oyster fishery, management of the fishery has been controlled to a large extent by state legislators. Initially,

laws were passed in an effort to conserve the fishery. However, more and more of those laws were repealed, or new ones passed, in an effort to appease the watermen, a very vocal minority with much influence in the state legislature. The sociopolitical influences have been disproportionately large and the state legislature has generally ignored the results of various scientific surveys and the reports of numerous advisory committees appointed to make recommendations to the legislature concerning the oyster fishery (Kennedy & Breisch, 1983).

Of all the states with a natural oyster fishery, Maryland is unusual in that it has persisted for over a century in maintaining an extensive public fishery while discriminating against private cultivation on leased Bay bottom. It has been over a 100 years since the first scientific investigators surveyed oyster grounds in the Maryland portion of the Chesapeake Bay, documented their despoliation and recommended conservation measures including private cultivation, or oyster farming. Other parts of the United States have been successful in oyster farming enterprises that are managed privately by individuals or corporations. By placing the responsibility for the fishery in the hands of those most likely to benefit from its success, conservation and production methods were employed to help ensure the long-term sustainability of the fishery.

Management of today's oyster fishery in Maryland is the responsibility of the Tidewater Administration of the Maryland DNR. However, important control over the management decisions and regulations resides in the Maryland General Assembly, the state legislative body that passes, and rescinds, the laws governing the fishery. Local county committees of watermen also play a key role in advising the Tidewater Administration on its fishery management decisions. Licensed watermen from each tidewater county select five representative licensed watermen from each category of tongers, dredgers, patent tongers, and divers to serve on the Tidewater Administration oyster committee for a term of 4 years (Maryland Department of

Natural Resources, 1994-1995).

The Chesapeake Bay, especially the Maryland portion, has been an ideal habitat for oysters (Kennedy & Breisch, 1983). Since before the turn of the century, many researchers and fisheries managers have indicated that the potential Maryland harvest could be increased and sustained substantially by combining a public fishery and private oyster farming (Quittmeyer, 1966). However, in spite of numerous recommendations from a variety of sources, no real action has ever been taken to encourage the private cultivation of oysters. The lack of regard by Maryland legislators for the results of extensive scientific studies and analyses even stimulated Bowman (1940) to use the Maryland oyster fishery as one of his three examples of the failures of attempts to apply science to social problems. He noted in his paper that the state legislators had chosen to ignore all the data and recommendations that were presented to them and chose instead to consult with the more practical (sic) watermen. One should note that at the time of Bowman's writing, disease and pollution were not factors in the decline of the fishery. The primary, if not sole, cause for the oyster population decline was overfishing by the watermen. Reflecting on the sociopolitical influences on the Maryland oyster fishery since the passage of the first oyster-related law in 1820 can be instructive because resource management involves not just an application of biological principles but also an interaction with social attitudes, many of which have been decades in the formation (McHugh & Bailey, 1957).

Though there is some archeological evidence of oyster fishing and consumption by Native American populations around the Bay, there was little written evidence until the 1800s, when production data were first collected. The first known tabulation of oyster harvests in Maryland was 710,000 bushels and was recorded in 1839 (Stevenson, 1894). From that time up to the late 1800s many large oyster reefs were discovered and the fishery expanded greatly. Meanwhile, the oyster beds of New England had become badly depleted throughout the 1700s by

overfishing (Ingersoll, 1881; Sweet, 1941). Up to this time, the center of the American oyster industry had been Connecticut. Having depleted their own stocks, beginning around 1808, dredge schooners traveled to New Jersey and Virginia to obtain oysters for the New England markets. Due to this increasing activity from nonresidents, Virginia passed legislation in 1811 prohibiting dredging in its waters, forcing the New England fleet north up the Bay to Maryland. Concern about such increased fishing led the Maryland Legislature to follow suit and in 1820 enacted its first oyster-related law, prohibiting both dredging in the state and transport of oysters from the state in ships not wholly owned by Maryland residents. Not to be defeated, New England businessmen began establishing branches of their oyster packing plants in Baltimore, Maryland throughout the 1830s. With improved transportation systems such as the railroad and roadways linking the states, New England packers were soon exporting increasing numbers of oysters out of the state. In addition, as demand rose, so did the number of local and out-of-state raw oyster packers, steam packers, and canners around the Bay. By 1874, the oyster harvest was estimated to be 14 million bushels, with a peak of 20 million bushels harvested in 1885. Associated with this great increase in harvest were changes in legislation concerning harvesting techniques or gear and fishing regulations.

In 1865, two major pieces of related legislation were enacted. The first abolished the old general oystering laws and enacted a new code, including adoption of a state-wide license system governing tongers and dredgers, called the General License Law. Thus the use of large dredges on boats under sail became legal again after 45 years. The large dredges were very effective and could reach the oysters living in deeper Bay waters. The new code did, however, prohibit the use of steam-powered boats or steam-powered machinery for harvesting, and enforced a closed season on dredging from June 1st to September 1st. For most of the Bay there was no closed season on tonging. The new code attempted a balancing act between trying to appease the

watermen by allowing the use of more efficient gear to reap the very profitable harvest from the Bay and trying to conserve the oyster population by imposing some harvesting limits.

The second legislative initiative allowed riparian landowners to plant oysters on five acres of leased ground. This privilege was later extended to any Maryland citizen. However, instead of using this privilege to increase production of oysters, most took advantage of the new law to use the ground for holding oysters until market prices for oysters went up and were more lucrative for their sale (Grave, 1912). This law drew a distinction between *natural oyster beds*, which could not be leased, and *barren ground*, which could.

The General License Law was extremely unpopular with the watermen, many of whom refused to obtain licenses or to abide by any other provisions of the new code. Consequently, in 1868 a State Fishery Force, popularly known as the Oyster Navy or Oyster Police, was established; consisting of both steamer and sailing vessels patrolled the Bay and its tributaries to enforce the law, with varying degrees of success. Run-ins between the watermen and the Force escalated over time, resulting in the sinking of several fishing vessels by cannon fire and the death of some watermen (Burgess, 1963).

The laws enacted by the Maryland Legislature prior to the 20th century were attempts to protect the public fishery and to manage the exploitation of a resource that was providing jobs for tens of thousands of Marylanders. It should be noted that all of this was done at a time when little was known about the biology of the oyster and the full extent of the natural oyster beds was not yet discovered since no formal survey of the oyster grounds had been conducted.

## Private Oyster Culture - Leasing Bottom

Regulatory history. In 1830 the One-Acre Planting Law was enacted, allowing Maryland citizens to use one acre of Bay bottom for planting and growing oysters. Unfortunately, at the

time, it was only a misdemeanor for others to harvest another's planted oysters without permission (poaching). The One-Acre Planting Law was the third in the nation to be enacted after New Jersey (1820) and Rhode Island (1827). This was later expanded to 5 acres in 1865.

A marked decline in the oyster harvest from the boom years starting in 1875 provided incentive for the General Assembly to commission the United States Coast and Geodetic Survey to study the extensive oyster grounds (Winslow, 1882). Results of this 2-year survey from 1878-1879, often called the Winslow Survey, included valuable descriptions of the structural and biological differences between older fished grounds and new, yet undiscovered grounds. Winslow (1881) even set up experiments in the Bay with tiles as spat collectors to study optimal conditions for spat settlement and oyster growth, but vandals destroyed most of his experiment. So distrustful were the watermen of government involvement in the fishery, even if it were intended for their benefit, that any attempts to gain knowledge of the fishery were often thwarted by those most likely to have benefited. Winslow was the first to advance the idea that cultch and thereby increased surface area, free from silt or other contamination, could increase oyster settlement and yield. Winslow also recommended that more limitations be put on dredging, that there be a closed season which included the spawning period and that before spatfall occurred that the watermen be required to add cultch back to the oyster beds to provide for more substrate. Winslow's recommendations were, unfortunately, generally ignored.

Later, Winslow (1884) recommended that the Maryland oyster fishery follow the example of the New England states which, having already overfished their own oyster grounds, had established private oyster culture on grounds leased from the state. Winslow noted that the yield in Maryland's public fishery was 40 bushels per acre compared with triple this yield in the northern states, which depended on private oyster culture on less acreage than that of Maryland's public fishery. Winslow believed that a common property resource was not easily conserved or

improved, whereas self-interest could inspire such aims in a private oyster planter. Since Winslow's time, there has been a flood of literature bemoaning the tragedy of the commons across the globe and many recommendations for limited access fisheries management strategies.

Winslow had recommended that a commission, free of political interference, be formed to oversee the management of the fishery. In 1882, a three-person Oyster Commission was established to examine the oyster beds and advise as to their protection and improvement (Brooks, 1905). However, reflective of the importance the Maryland Legislature would place on the Commission's recommendations, the legislature provided no financial support for the Oyster Commission's work.

The Oyster Commission recommended conservation measures and a system of private oyster culture beyond that envisioned in the expanded Five Acre Planting Law (Brooks, Waddell & Legg, 1884; Grave, 1912). It recommended annual surveying and marking (delineating) of the oyster grounds by the oyster police. It advocated that oyster beds should be closed to harvesting where and when necessary to allow for rehabilitation, spawning, and growth, and that the opening and closing of areas should be decided upon by experts. Oyster shells should be returned to the beds to serve as cultch.

In *The Oyster* (1905), Brooks presented the findings of the Oyster Commission. In it he strongly urged that there be private oyster culture on Bay bottom leased from the state and reiterated the success of private culture in rehabilitating the depleted oyster populations in New England. Brooks described a number of advantages of private culture, noting that some harvesting and processing activities contributed to the depletion of the fishery, and suggesting that oyster farming could alleviate these problems. The strong recommendations by Winslow, Brooks, and others in favor of private oyster culture were vehemently rejected by many stakeholders for a number of reasons, particularly by the watermen.

While the legislature ignored many of the recommendations of the Oyster Commission, it did pass the Cull Law in 1890, which required that shells with spat and young oysters be thrown back, culled, on the beds from which they were harvested. This was and can be an efficient method for protecting oyster beds and conserving the diversity of the population (Grave, 1912). Maryland was one of the first states to pass such a law. However, it was extremely unpopular among the watermen, who had been selling the undersized (legal market size then was 2 ½ inches) oysters to steam canners or had been selling them to private oyster growers out-of-state as seed (Brooks, 1905). Most watermen ignored the law and it was poorly enforced.

However, as harvests declined at the turn of the century and oyster packing houses closed their doors, demands for state action increased. Demands for protection of the oyster beds through enforcement of cull and gear laws, as well as enhancement of production through leasing, grew (Leffler, 1987a). The demands became so heated that even strong opposition from tidewater counties could not stop the passage of the Haman Oyster Act in 1906. It was the most far-reaching attempt in Maryland to this day to open the doors to private oyster culture in the industry's history.

A strong advocate of private oyster culture was a Baltimore attorney, B.H. Haman, who submitted a number of bills to the Maryland Legislature related to oyster culture. For support for these bills he had turned to the inland Maryland counties, describing the potential increased revenues that could accrue from a revitalized oyster fishery and linking this with the opportunity to improve state roads and bridges ("Good roads and oyster planting," 1903). After intense political maneuvering and controversy, the Haman Oyster Act was passed in 1906. It allowed individuals to lease up to 30 acres of barren bottom in county waters and up to 100 acres in the Bay's open waters beyond county boundary limits. Such leases were to be on ground found to be barren by a survey performed by the Shell Fish Commission, which was provided for in the law

(Kennedy & Breisch, 1983). In 1906, in cooperation with United States Coast and Geodetic Survey, the Commission began an ambitious 6-year survey of the natural oyster bars in the state of Maryland.

Unfortunately, there were several shortcomings to the Haman Oyster Act that served to discourage any potential private planters from risking the investment. The Legislature allowed the opponents of the bill to include in it arbitrary restrictions on the area that could be leased and defined as barren ground, on the types of gear that private planters could use on their own beds and on the seasons open to harvesting on leased plots. In addition, unlike the watermen that were harvesting from the public beds, the private oyster farmers or culturists had the expense of leasing fees, purchasing and placing shell on the bottom to build up substrate, and the purchase of seed. While amendments to the Haman act in the succeeding years would destroy any chance it had to be really effective, the Haman Act is still the basis for oyster farming in Maryland today (Case studies in management, 1991). State regulations favoring the reseeding of public bars virtually prevented the sale of Maryland oyster seed to leaseholders, which meant that private planters had to go to Virginia to buy seed. Since the Oyster Police were underfunded and understaffed, many instances of poaching occurred leading to hesitation in risking money and effort by planters whose crop might be stolen overnight. As William Brooks (1891) had pointed out in his book before the turn of this century, "The most serious obstacle to the development of a great planting industry in Maryland is the absence of all respect for private property in oysters" (p. 139). The poaching of planted oysters is as severe now as it was in Haman's time and can be a significant factor for those who lease oyster bottom. If that were not enough to kill the desire of most Marylanders to lease bottom for oyster cultivation, to prevent a monopoly of any sort, corporations or joint stock companies were prohibited from renting oyster grounds for cultivation. This particular restriction was and is unique to the state of Maryland among states

with an oyster fishery.

In response to concerns about these shortcomings of the Haman Oyster Act, the Price-Campbell Act was passed in 1912. It allowed for the additional leasing of up to 100 acres of barren bottom per lease in the Tangier Sound part of the Bay and increased allowable Bay holdings to 500 acres. It allowed the lessee to use dredges and extended the lessee's working season. However, the Price-Campbell Act did not change the regulations against corporate holdings or use of powered equipment.

Another shortcoming of the Haman Oyster Act was the attempt to make the results of the 1906-1912 oyster survey a permanent determination of the character of the Bay bottom without flexibility to allow for changes in future conditions. Thus, natural ground might become barren from disease or over harvesting, or barren bottom might become replenished naturally (Kennedy & Breisch, 1983). However, this could not be taken into account by the Commission because the watermen had insisted on a rigid design for the survey to guard against further shrinking of the legal boundaries of areas designated as natural grounds. Unfortunately, even at that time, it was recognized that shrinkage of productive grounds was occurring rapidly.

Passage of the Price-Campbell Act in 1912 had led to an increase in applications for leases (Fairbanks, 1932), with a parallel increase in protests from watermen that a ground for which there was a leasing application was natural and not barren bottom. This ill-informed and deliberately obstructive behavior occurs even today whenever someone applies for a new lease. Due to the increasing number of protests and the formation of county-based watermen's associations, pressure mounted to change the leasing act.

Hence, the Anderson Bill was introduced in 1914 to repeal the Haman and Price-Campbell Acts. Understandably, this greatly angered supporters of private culture among the watermen, scientists, and the Commission. In March 1914 the *Baltimore Sun* ("Oyster politics,"

1914a, 1914b) noted in an editorial that watermen comprised less than 20% of the population in the tidewater counties, a numerical strength much less than their political strength. The clamor that arose from the public against the Anderson Bill resulted in its being replaced by the Shepard Bill, which was designed to be more helpful to planters.

In the Spring of 1914, the Shepard Act was passed, establishing a neutral zone 50 to 200 yards wide around natural bars where no person could plant or cultivate oysters. Essentially, this just enlarged the area of natural oyster bar where watermen were allowed to work and planters were not, so territorial disputes continued (Green, Revell, & Maltbie, 1916). There was a provision in the Shepard Act for the reclassification of oyster grounds either on the initiative of the Board of Shell Fish Commissioners or by any three or more residents that wished to dispute a barren bottom designation. Thousands of acres were reclassified as natural grounds as a result of challenges in court to lease applications (Powers, 1970). The Shepard Act has to this day effectively hamstrung the granting of oyster leases.

From the time of the Great Depression onward, concerned organizations or the Maryland General Assembly, periodically commissioned reports on the state of the oyster fishery (Fairbanks, 1932). In 1932 the Baltimore Association of Commerce reviewed the history of the oyster fishery and of leasing. It recommended that the Conservation Department be given full rein to resurvey and reclassify unused oyster grounds to allow for increased private culture and to repeal the restrictions against corporate involvement in private culture, and to strengthen the laws to require planting of shell or oysters on leased bottom within specified time periods.

Another Commission reviewed the fishery in 1936 and blamed the continuing population decline on overharvesting, export of seed oysters to out-of-state planters, and the failure to return shell to the beds (Kennedy & Breisch, 1983). Like the Baltimore Association of Commerce, it recommended a change in the leasing laws including allowing for larger holdings and lifting the

restrictions on corporate holdings, and that the authority to regulate this, not just administer it, be given to the Conservation Commission.

In 1943 the Tidewater Fisheries Department developed an Oyster Management Plan to gradually increase production and annual harvests from 1944-1978 (Bowman, 1948). It was to be financed from general funds and a tax on harvested oysters. Shell cultch and seed oysters were to be planted in appropriate areas. However, poor enforcement resulted in a failure to collect the tax ($0.20/bushel) and the quantities of seed and shell available were not sufficient to be very useful. Ironically, the practice of seed and shell planting continues even today, at taxpayer's expense. The annual oyster seed and shell planting program, the Repletion Program, is considered by state fisheries managers to be one of the most important management practices for maintaining levels of production during periods of poor natural reproduction (Ulanowicz, Caplins, & Dunnington, 1980).

Over the years, the state of Maryland and particularly various tidewater counties have put into place laws whose aims were to protect the Bay oyster against the kind of unregulated overfishing that ruined the fishery in New England. There, oyster harvesting had largely come to an end and was replaced by private leaseholds for oyster farming which have become the mainstay of and are the oyster fishery of New England today (Hedeen, 1986).

Despite the long-standing Maryland legislation that authorizes leasing, state support has gone toward conserving and rehabilitating public oyster beds, through shell and seed planting programs, regulations that set minimum legal catch size (3 inches), limits to harvests, and restrictions on the kind of gear the watermen can use (Leffler, 1987a).

While Maryland was one of the first states to try to regulate overharvesting with restrictions that included licensing fees, gear limitations, and eventually, minimum cull sizes, the laws did not effectively limit the number of watermen and the immense harvests. In the late

1800s there were over 28,000 watermen working on the Bay. The predicament of Maryland's oyster fishery was foreseen over a century ago, and the recommendations of the various commissions, if enacted, could have prevented the poor state of today's fishery. If, as Hedeen (1986) has suggested, the state had listened to its oyster biologists and allocated sufficient funds for enforcement and to spread the message of conservation to all elements of society, the situation might be quite different today. Instead, the legislators succumbed to political rather than ecological considerations in rehabilitating the fishery and created major barriers to hinder the private propagation of oysters.

## Significance of this Study

The Chesapeake Bay's celebrated oyster population has been ravaged by overfishing, disease, and pollution. This single fishery once provided a quarter of America's oysters but, if current trends continue, it may soon become a memory. The decline of the oyster population has had a significant impact on the communities surrounding the Bay. Beyond the loss of oysters and other Bay species that depend on the oyster reefs for habitat, lies another threat, and that is the loss of a way of life that people have come to associate with the Chesapeake Bay. The oyster population, the Bay ecosystem, and the socioeconomic institutions and value systems of the Tidewater communities are irrefutably intertwined. As the oyster population continues to decline, the health of the Bay will increasingly decline, and the community structure that the Bay provided for centuries will be lost, as will be the watermen that make their living from the Bay, the tidewater towns, and the communities. As those things which make up the character of the Bay are lost, in a sense, the Chesapeake Bay itself is lost.

Such crises, which threaten livelihoods and community sustainability, should call fisheries managers to action to explore and develop alternative approaches to issues such as the

management of access to, and participation in, the fishery and the socioeconomic organization of fishers, their communities, and their industry. Those most dependent upon fishing as their livelihood will be confronted with widespread reductions in the availability of fisheries resources, and very uncertain economic and social futures. It is important to understand how and why the Maryland oyster fishery has reached its present state and explore alternative management strategies because the fishery is not just a commercial enterprise that can easily be abandoned for another. The oyster fishery is an ecological lynchpin for other species and the Bay ecosystem as a whole. Most importantly, the fishery is a way of life.

## Definition of Terms

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| *Barren ground* | Bay bottom that is not considered to naturally support oyster or clam populations without human intervention. Also, any Chesapeake Bay bottom represented as barren on the charts of the Oyster Survey of 1906 to 1912 and its subsequent amendments. |
| *Benthic* | Bottom dwelling, as in organisms that live on the bottom beneath a body of water. |
| *Brood stock* | Populations of adult oysters that will spawn to produce the next generation of oysters. For aquatic species that expel their eggs and sperm into the water column, the brood stock population must be large enough and close enough to each other for the eggs and sperm to come in contact with each other. |
| *Buy boats* | Any boat engaged or used in buying, selling or transporting oysters caught on other boats. |
| *Culling* | Shells with spat and young oysters are separated from market sized (3 inches from hinge to bill) oysters and thrown back on the beds from which they were harvested. |
| *Cultch* | Oyster shell or other hard material where free swimming oyster larvae set and grow. |
| *Dredgers* | Watermen who scoop or scrape oysters from the bottom by dragging a dredge over the oyster beds. |

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| *Estuarine* | Water that is a mix of salt/ocean and fresh water. Point at which tidal water meets river currents. |
| *Farm oysters* | Sow seed, cultivate and protect oysters on bottom lying beneath the water that is leased from the state. Aquaculture. |
| *Gear* | Fishing equipment such as tongs, patent tongs, dredges or scuba outfit and tanks. |
| *Hand tongers* | Watermen who dislodge and pull oysters up from the bottom with long, wooden-shafted tongs (pincers, nippers) tipped with metal rakes. |
| *Larva, larvae* | Free swimming pre-adult stage of an oyster; when first spawned, an oyster larva may swim for two to three weeks before settling down. At this time the oyster develops a foot, settles to the bottom and attaches itself (sets) to a hard, clean substrate, cementing itself to a permanent location, usually on other oyster shells. |
| *Moribund* | In a state of dying or approaching death. |
| *Natural oyster bed* | Any bed or reef beneath the waters of the state where the natural growth of oysters is extensive enough that the public has resorted at one time or another to the bed for a livelihood. Also, any bed or reef represented as an oyster bar/bed or reef on the charts of the Oyster Survey of 1906 to 1912 and its subsequent amendments. |
| *Patent tongers* | Watermen who have equipped their boats with tonging (pincers, nippers) rigs that are raised with rope, cable or other hoisting gear. |
| *Planting* | Put or place oyster seed on the bottom beneath the water for growth to market size. |
| *Repletion Program* | Oyster seed and shell are planted on public oyster beds by the state. Oyster shell is collected from oyster processors or mined from large deposits of old buried shell and then planted on the public grounds. The availability of this material, called cultch, for the larvae to attach to increases the number likely to set and mature to market size. |
| *Riparian* | Pertaining to the banks and bottom of a natural course of water such as creeks, coves and inlets. |
| *Seed oysters* | Young oysters generally less than one year old. |
| *Sessile* | Permanently attached or fixed, not free-moving. |
| *Setting* | When oyster larvae settle upon and attach themselves to a substrate, usually oyster shell. |

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| *Shucking* | Removing the shell of an oyster or clam. |
| *Skipjack* | Sloop-rigged, wide-beamed, shallow-draft sailing vessels whose design is unique to the Chesapeake Bay. Reportedly named after a fish that skips along the surface of the water or is an archaic English word meaning "inexpensive yet useful servant." Built specifically for oyster dredging in the 1800s. Designated the official Maryland state boat in 1985. |
| *Spawn* | Produce or expel eggs or sperm. Oysters spawn by releasing sperm and eggs into the water column, where fertilization occurs. |
| *Spat, spat set* | Oyster larvae which have completed the free swimming stage of their lives and have settled on a permanent location. |
| *Suspension-feeders* | Organisms that feed off of organic material suspended in the water column. |
| *Tidewater* | Refers to geographic area or counties that border the Chesapeake Bay. Derived from term meaning land that touches tidal waters. |
| *Tongs* | Scissor-like devices used to harvest oysters consisting of long poles with a toothed rake at the end of each. Design originated with the Native Americans. |
| *Watermen* | Local term, specific to the Chesapeake Bay, to describe the fishers of the Bay. Fishers that work within the confines of the Bay and not in open ocean. Traditionally the fishers on the Bay have been almost exclusively men. |

# CHAPTER 2

## Review of the Related Literature

## Property Rights as Fisheries Management Strategies

### Fisheries Management Processes and Organization

Commercial and subsistence fisheries around the world are both in crisis, most likely because of over-fishing as a consequence of too many people and too much fishing effort chasing too few ocean resources, frequently in an ecologically disastrous manner (Jentoft & Davis, 1993). This explanation may be overly simplified, but there is no doubt that those most dependent upon fishing as their livelihood will be confronted with widespread reductions in the availability of marine resources and very uncertain economic and social futures.

Such crises, which threaten livelihoods and community sustainability, frequently renew interest in exploring and developing alternative approaches to issues such as the management of access to, and participation in, fisheries and the socioeconomic organization of fishers, their communities, and their industry. For example, within the last decade alternative approaches to fisheries management have been suggested and explored, ranging from the implementation of *individual transferable quotas* (ITQ) through government-fisher cooperative management arrangements to fisher self-management (Jentoft & Davis, 1993). Interest has also served the ways and means of developing organizational approaches dedicated to enhancing the socioeconomic viability and the sustainability of localized small boat fisheries and the coastal communities dependent upon them.

The traditional view of fisheries managers has been that they are professionals who manipulate fin/shellfish populations and their habitat. This view has changed radically within the past 2 decades. Fisheries management professionals are now moving toward the belief that they primarily manage people and secondarily manage fin/shellfish populations. Unfortunately, old habits die hard and change in the fisheries management culture has been slow.

In following the traditional view, the concept of fishery management fell under the rubric of fishery science, and the education of those who eventually managed fisheries was primarily in the biological and natural sciences. Eventually, it was recognized that there was a dichotomy between the education of those who develop scientific information and those who manage fisheries. In other words, there was a need to be better prepared to function in the nonscientific aspects of fisheries management, that is, in the management of people (scientists, fishers, government regulators).

The evolution of fishery management goals in the Western world can be divided into three periods that represent stages of increasing complexity of fishery management issues. The first period might be considered the pre-1900s. In that era, implied goals were laissez-faire and there was recognition that hard political choices would have to be made if there were management decisions leading to disruption of the free-flowing lifestyle (few, if any regulations) of the fishers. This was a period of essentially no fisheries management with, seemingly, a refusal to recognize depletion as a possibility. If fisheries management institutions/agencies/organizations admitted that depletion occurred, they minimized its effect on fishing with supplemental plantings (stocking) or transplantation of nonresident species and exotics (Barber & Taylor, 1990).

During the next period, from the early 1900s to the late 1960s, *maximum sustainable yield* (MSY) was the management goal. As a consequence, maximizing the harvested catch was an explicit goal and managers focused on maintenance of fin/shellfish populations and establishing appropriate harvest levels for long-term yields. Other implied goals of fisheries management involved economic and social considerations, such as maximizing employment. Approaches by fisheries management organizations continued as in the past, but habitat manipulation techniques were also developed, as were various types of restrictions on fishing

efficiency.

Within management approaches to maintain MSY, there was implicit recognition of social and economic concerns. Criticisms of, and failure of, the MSY approach however, produced the current era in which fisheries managers now explicitly recognize that social, political, economic, and biological goals must all be addressed. The current guiding concept is *optimum yield* (OY). The industry stakeholders, comprising the fishers, processors, packers, and restauranteurs, argued that the primary difficulty with maintaining and managing for an OY was open access to a common resource, with its attendant allocation problems. In these arguments, social and economic goals were identified, such as full employment or maximizing profit. Consequently, *limited entry* (limited access to the resource) or restricted fishing rights, in its many different forms, became a more recognized and applied tool of fisheries management (Barber & Taylor, 1990). Inherent in the goal setting for OY and limited entry was the real challenge to fisheries management, determining appropriate harvest/fishing limits, implementing them, and enforcing them. To calculate OY, one begins with the biological concept of MSY, that being the greatest amount of fin/shellfish that can be caught every year without permanently diminishing the stock (McManus, 1995). Next, the MSY is usually adjusted up or down, depending on political pressures.

The mathematical neatness of this management process is deceptive. Its biological component depends on accurate data concerning living, and in some cases, highly mobile organisms, perhaps adjusted for predicted variations in the weather, prey and predation, and disease. Its economic component depends on the ability of state and/or federal regulators to predict the behavior of regulated interests. In addition, it must be implemented by means of institutional arrangements and procedures that are currently deeply flawed.

To generalize, efforts have focused on management measures that restrict fishing effort

by various command-and-control stratagems, such as closed fishing seasons or limited seasons, fishing gear restrictions, closed areas, or catch quotas, all of which are government-regulated and controlled (McManus, 1995). This current state of affairs is easy to take for granted, but some fisheries academics consider it symptomatic of management regimes doomed to failure.

Fisheries management has frequently been defined as *the analysis of alternative decisions and implementation of these decisions to meet human goals and objectives for the utilization of aquatic resources*. A key point is not the decision-making process itself, but its role in accomplishing predetermined goals and objectives for utilizing fishery resources. Fisheries management is more inclusive than just the decision-making process for utilizing aquatic organisms. It also incorporates human interests in how the habitat and human resources are to be utilized and considers that the use of these resources is greatly influenced by external social, legal, political, scientific, technical and economic goals, objectives, and values.

There are many criteria and objectives by which methods of fisheries management can be judged. For example, biologists are interested in the maintenance of adequate recruitment (of species) or improvement in recruitment, population age structure, and genetic diversity. Economists are interested in the long-term achievement of these goals in an economically efficient manner. Economic efficiency is loosely defined here as society's ability to maximize the combined value of commercial, recreational, and aesthetic products and services that can be obtained for a given level of cost, or the achievement of a given level of products and services at minimum cost (Waters,1991). Unfortunately, economists have not yet grasped the economic benefit to habitat maintenance and ecological diversity and tend to have an anthropocentric view in defining monetary values for natural resources (Smith, 1993).

Marine fisheries today represent a version of Hardin's (1968) now famous *tragedy of the commons* in which fishers, each acting in his or her own self-interest, are compelled to overfish

and deplete the resources upon which they depend. Fin/shellfish are said to be common property because no individual owns the ocean or the living creatures in it. Hence, fin/shellfish have generally been harvested on a first-come-first-served basis by anyone with appropriate fishing gear, subject to existing regulations by state and federal governments as trustees of the public's natural resource (Waters, 1991). This creates a situation in which what is optimal for an individual fisher is not always optimal for all fishers combined.

The field of natural resource management is undergoing a fundamental transition. The development of a global free economy, the onset of unprecedented diversity in the workforce, the degree of competition, and the apparent necessity of integrating the private sector with the public sector in mutually supportive ways that protect the integrity of both, are all trends that demand an exceptional level of excellence in performance from organizations of all types. Perhaps as a reflection of the obvious need for new ways of organizing and managing, is that the debate between advocates of hierarchical versus participative modes of organizing has virtually vanished from the scene. Such controversy seems irrelevant and off the point, given the scale and depth of the changes that appear to be required.

Historically, open-access, and even limited-access policies have led to overcrowding by fishers and overcapitalization of fisheries, contributing to or exacerbating overfishing, escalated by-catch problems (unintentionally catching nontargeted species, e.g., dolphins in tuna nets), waste, user conflicts, high management costs, and economic inefficiency (Hinman & Paulsen, 1993).

Too often, marine fisheries are characterized by (Alverson & Larkin, 1992):

1. A continued trend toward overcapitalization.
2. Inadequate statistics and scientific information about the exploited resources.
3. Failure to take timely measures.

4. Inability to monitor and influence necessary management regimes.

5. Continued squabbles about shared and transboundary stocks.

When fisheries management fails, there is a tendency to point the finger at the fishing industry itself as greedy, uncaring, morally bankrupt culprits responsible for overfishing and for incidental and indirect impacts on habitats and other marine organisms. Responsibility for natural resource management has been, and still is, vested in state and federal governments. Though there is some truth in the perception that the fishing industry itself is only interested in its own short-term gains, governments ultimately bear the responsibility for the historical course of natural resource management (Alverson, 1995). For in reality, the fishing industry maximizes its economic opportunities within a competitive environment, social attitudes, and legal regimes. If industry pressures overly influence those responsible for policy and regulations and their enforcement, the fault lies with policy and decision makers, enforcement officials, and their political masters.

Unfortunately, politics is the stuff that fisheries management is made of: fishery scientists playing in the high stakes game of fishery politics soon find that politics trumps science. However, the politics versus science scenario is an integral part of the mechanism that will forge the fisheries of the future. An important part of selling science to those involved in fisheries is having credibility and standing in the political and regulatory process (Radonski, 1995). Some of that comes from breaking down the us-versus-them barriers. In addition, scientists must be able to articulate science on the level of the users of the fishery resource.

The principal issues that will drive fisheries management are determination of fishery management objectives, control of exploitation and rebuilding of depleted marine fin/shellfish stocks, allocation of harvestable surplus, and who will pay the costs of fisheries management (Radonski, 1995).

The outcome of critical management decisions is likely to depend on the quality and believability of the facts presented regarding the risks versus expectations of making a particular decision. In a fishery setting, the sector of society involved in or influencing decision making has, until recently, been narrow and mostly government but frequently weighted toward the users themselves. However, during the past decade, the principles of fin/shellfish and other natural resources management have been in transition, and the breadth of societal involvement has greatly expanded.

If from some time in the future a backward look at the history of marine fisheries use reveals failure, then the societal check-and-balance mechanisms and institutional arrangements for their implementation, need serious adjustment now. Perhaps the appropriate question is whether existing institutional arrangements can remedy the perceived problems and whether the political will can be mustered to modify human behavior adequately.

A General Overview of Property Rights Theories

Developing a fisheries management strategy is a challenging prospect in itself because of the complexity of problems associated with fisheries. Fish, finfish or shellfish, inhabit an environment that is so variable and often so vast that fundamental biological relationships remain largely unknown. In addition, fish are wild and cannot be managed directly but only indirectly, by controlling the behavior of one of their primary predators, humans. In a perpetual cycle of regulatory action and reaction, fisheries management becomes increasingly more difficult (Sylvia, 1992). Yet while demand for fish and fishing effort increase, fish remain constrained within the limitations of the natural world.

Fisheries management has long had a history of biological orientation, which often means that the goals of management focus upon issues related to stock size and yield rather than

on other equally important issues such as the long-term costs, benefits, and social impacts of the regulatory controls developed to meet the yield or stock objectives (Sylvia, 1992). The common result is short-sighted analysis and the implementation of regulations that ultimately fuel future management crises.

Two of the major problems in fisheries management that have been explored more recently by researchers from both the social and biological science disciplines are the problems of managing common property and of dealing with resource uncertainty. According to Sylvia (1992), the common property problem is characterized by two major concepts. The first is that like most hunting industries, the size of the resource is limited by the carrying capacity of the natural environment. The second and more important concept is that without effective management institutions users will ignore their long-term aggregate impacts on the resource and collectively increase their efforts until net gains can no longer be realized (Gordon, 1954). Since most fish stocks cannot be cost-effectively augmented by seeding or other forms of restocking, increasing fishing effort and harvests will affect the ability of the resource to renew itself, ultimately resulting in a reduction in the size of the stocks and harvests to levels below what might be most beneficial to society.

Fisheries resources show high variability, often as a result of changes in the natural environment. This variation significantly increases risk, makes it difficult to forecast future resource supply and complicates the design of fisheries management schemes. Since the aquatic environment is so environmentally complex, it confounds a fisheries manager's ability to understand even the most basic issues affecting the size and behavior of the resource.

The debate over the effectiveness of the fisheries policy process has led managers to explore methods for strengthening the fisheries policy process and for improving social benefits. Management strategy research has focused primarily on rights-based management systems and

fisher behavior. According to Sylvia (1992), advocates of rights-based management systems argue that traditional bureaucratic and politically oriented strategies for managing natural resources are fundamentally flawed because they separate authority from responsibility. They also believe that when resource users have rights to resources that the evolving market system ultimately leads to resource use that is more effective, efficient, and fair than traditional systems. Though rights-based resource management systems are certainly not without their problems, they continue to gain support from fisheries managers and scientists because of the inability of traditional management systems to effectively address fisheries management issues.

Traditional fisheries management systems have been severely criticized for their focus solely on the behavior of fish while ignoring the behavior of fishers (Opaluche & Bockstael, 1984). In their study, Opaluche and Bockstael showed that ignoring the interrelationships of fish, fishers, and regulators inevitably leads to the adoption of regulatory strategies that fail to meet long-term objectives. Usually this results because the regulation acts as an incentive for fishers to increase effort in ways that are not yet regulated, resulting in behavior that may be beneficial for the individual fisher, but not for society as a whole.

From an economic perspective (Karpoff,1987), the effectiveness of a pluralistic process that integrates rights-based systems and fishers' behavior will be limited if fisheries managers continue to rely heavily on crisis-driven political agendas. Management strategies that enhance the wealth, or minimize the loss, of those who are contending for control over the resource will tend to predominate. Meanwhile, strategies that are broader in scope and that would include analysis of impacts on groups receiving indirect benefits, including supporting industries and the community itself, receive far less attention. Comprehensive analysis requires foresight and planning, a high degree of cooperation and a recognition of the role that socioeconomic policy information can play in guiding and improving the fisheries policy process. Proponents, like

Sylvia (1992), of rights-based fishery management systems argue that only rights-based management rather than traditional management systems can effectively (a) capture the complex and dynamic technological, market, and biological information that characterizes the fisheries problem; (b) make the appropriate behavioral and market adjustments; and (c) act to promote not only their own interests, but also the interests of the community and the state.

The granting of territorial use rights in fisheries (TURFs) to fishers' organizations, similar to that practiced in Japan, has been gaining acceptance worldwide as a management tool for small-scale fisheries (Siar, Agbayani, & Valera, 1992). Open access in fisheries has resulted in wasteful exploitation of the resource; fishers are unable to regulate their catch, economic waste is brought about by too much effort on a finite resource, there is decline in fishers' income, and conflict has developed between fishers with the same gear for the same resource, or between those using different gear for the same resource (Christy, 1982; Hardin, 1968). This is Hardin's well-known tragedy of the commons. The participation of fishers themselves is believed to be the key to achieving long-term fisheries management goals (Ferrer, 1989). Community-based management has proved effective in maintaining coral reef habitat, improving species abundance, and arresting the decline of coastal productivity in the Philippines (Alix, 1989; White, 1988, 1989). The granting of TURFs to fisher associations, similar to that practiced in Japan (Ruddle, 1987), is gaining popularity as a management tool for municipal fisheries also (Lacanilao, 1989).

One of the barriers to introducing TURFs as a fisheries management strategy in coastal communities is that, generally, the economic standard of living is low and incomes are closely tied to the fishery (Smith, 1979). Acquiring TURFs may not solve the overfishing problem in an already overcrowded fishery. To reduce fishing effort, the granting of TURFs must be coupled with the introduction of other sources of livelihood. These could come in the form of

aquaculture or land-based activities. Such alternative employment activities could alleviate the low economic standard characteristic of coastal fishing communities. As a legal right, TURFs become meaningful when placed within the context of what is sustainable and economically beneficial to fishers. They can contribute to raising fishers' standard of living and protecting the environment from destructive fishing practices. A sustainable fishery may be more possible through TURFs or some variation on TURFs than by current management strategies that are under the auspices of government-controlled fisheries. As the majority of fishers are still solely dependent on fishing or fishing-related activities for their livelihood, the concept of, and rationale behind, community-based management may be a step in a new direction worth considering.

The real challenge for fisheries managers, Sylvia (1992) feels, is to develop management systems that reconcile people's diverse values and dynamic behavior with the complexities and limitations of the natural environment. Resource managers must develop management systems that not only rationally conserve the resource but are to a great extent effectively self-regulating. It must be a management system that provides the users with the responsibility and the freedom to directly determine how they can most effectively use the resource, in other words, a rights-based management system.

The problems associated with managing collective or public resources arise when individuals must cooperate to achieve a goal that is in both their collective and their individual interests. As McKean (1992) points out, even in the face of declining fish stocks, fishers will persist in overharvesting if they perceive that the individual short-term costs of cooperating exceed the long-term collective benefits. In order for sustainable management and regulation of a publicly or collectively held resource to succeed, there has to be what Garrett Hardin (1968) described as "mutual coercion mutually agreed upon." Margaret Levi (1988) makes it clear from

her analysis that the need for cooperation even in the interest of survival is an inadequate motivation to cooperate.

The definition of property and property rights is often confusing, which is unfortunate because different arrangements of property rights have different consequences for management of the resources in question. Common property is probably the most misused term in property rights discussions. Its definition ranges from unowned resources to which no one has recognized rights nor the right to restrict anyone else's use of the resource, to public property which is property owned by the state and ostensibly held in trust for the well-being of the general public and is often accessible to the public, to jointly-owned private property which is property held in common by a group of people that have exclusive use of the resource. Unowned resources are the most vulnerable to degradation because no one has the right to keep any one out or to limit use. McKean (1992) points out that public property can be just as vulnerable to overuse as unowned property because it is subject to severe principle-agent disease. Ownership of public property, she explains, is vested in the public. However, the public's representatives are usually state legislators, who provide inadequate funds to police it and who are often physically too far removed from the resource to assess the damage.

McKean's point is readily illustrated when one looks at the oyster fishery in Maryland. Though more locally based DNR officials are left to administer the fishery regulations on the Chesapeake Bay, it is the legislators in the state capitol of Annapolis that make the laws and allocate the funds to enforce and administer those laws.

Private ownership of a resource has more to do with exclusivity of use than it has to do with number of owners or actual ownership. As is the case in Maryland, private property rights are extended to those who lease oyster ground from the state for the cultivation of oysters and the lessee has exclusive rights to the leased ground, albeit with some state-imposed restrictions.

Limiting Access to a Common Resource

In *No More Fish in the Sea* (1994), Caroline Wheal points out a commonly held theory that if you give fishers a stake in the resource, they will be more likely to conserve for tomorrow what they do not catch today. Rights to a common resource becomes a privilege granted to select fishers in the form of licences/permits for rights of access, leased territory, or gear restrictions. In regions such as New England or the Chesapeake Bay where generation after generation have been fishers, any change in the system by which these privileges are granted is hard to implement and can drastically alter the way the community functions.

In his report on the Northeast fishery, *Beyond Denial* (1995), Charles Collins warns that if fishing pressure on the resource is not reduced, the Northeast fishery crisis will rapidly become the whole Atlantic Coast fishery crisis. To bring fishing effort into line with the amount of fish that can be harvested, the number and ability (type of gear) of the boats have to be cut by 50%, Collins believes. In New England, government buy-outs have been proposed, in which fishers would be paid for their boats (below market value, many fear). Many taxpayers wonder why government should bail the fishers out at all. In the long run, however, the government will end up paying one way or another, either through buy-outs or welfare.

Since the 1950s, economists have recognized that the structure of property rights affects the way people use a natural resource (Coase, 1960; Gordon, 1954; Santopietro & Shabman, 1992a; Scott, 1955). As a result, economists have expanded the study of particular property rights systems to how property rights systems change over time. The new resource economics (NRE) literature offers one perspective (Anderson, 1982). When stakeholders identify alternative property rights systems that can enhance the potential economic value of the resource, change results. The stakeholders then enter the political arena to bring about the necessary changes to capture these economic benefits for themselves (Anderson & Hill, 1976; Gardner,

1985). In accord with this economic decision model of individual choice, in which individuals pursue their own self-interest, stakeholders trying to bring about change take political action based on a marginal analysis of their benefits versus their cost. Included in the cost analysis is the cost of transactions to bring about change. The result is a change in property rights that enhances the economic value of the resource.

However, another group of economists have an entirely different approach on property rights that considers more than just the opportunities for efficiency gains (Runge, 1985; Schmid, 1987; Shabman, 1985). This alternative approach uses not only the distribution of economic benefits, but also the social values, environmental conditions, and noneconomic sources of political power as determining factors in the evolution of property rights systems.

Anderson and Hill (1976) point out that the advocates of the NRE approach generally propose replacing open-access and common property rights with private property rights because "When exclusivity and transferability are insured through private property rights, resources move to their highest valued alternative subject to the constraint of positive transaction costs" (p. 938). In other words, the NRE advocates believe that economic forces not only drive changes in property rights but move them to attain economic efficiency (Dahlman, 1980).

Transaction costs are the key to the move toward privatization and subsequently, innovative approaches to greater efficiencies. The cost of establishing and enforcing property rights are a part of these transaction costs. Therefore, private property rights evolve either as the resource's economic value increases to the point that stakeholders find it worthwhile to bear the transaction costs, or as the transaction costs decline, becoming less of a barrier to privatization (Santopietro & Shabman, 1992b).

As Santopietro and Shabman (1992b) explain it, from an NRE perspective, the role of the economists and social scientists that are advising fisheries managers, is to design and

promote policy reforms that encourage movement toward private property rights of natural resources. This often means finding ways to reduce transaction costs. Those less enamored with the NRE approach are not as convinced that private property rights to natural resources provide the best management strategy toward resource conservation and sustainable harvests. It is perhaps naive to assume that all fisheries stakeholders, including the economists, scientists, and managers, are striving toward conservation and sustainability goals, but it is reasonable to assume that they are part of any stakeholder's operational strategy *if* there is to be a fishery at all. Those skeptical of the NRE approach are careful to draw a clear distinction between open access, in which access to a resource is unrestrained and common property, in which access is limited to members of a specific group (Ciriacy-Wantrup & Bishop, 1976). Common property is the case in which ownership of the resource is held by a group, and rules for access to, or use of, the resource are established by the group or some regulating body. In this respect, common property and limited-access property can be considered the same. The public oyster fisheries (Maryland and Virginia) of the Chesapeake Bay are a limited-access fisheries in which the group that has access is limited by required licenses and further limits are placed on the fisheries by season and gear restrictions. Pure private property exists only when the government grants to a single economic agent (individual or corporate) discretion over all resource exploitation decisions. The private oyster fisheries of the Chesapeake Bay are not truly private in this strict interpretation. They are in a sense a cross between a very exclusive limited-access property and true private property. For in fact, the state still owns the property, in this case Bay or river bottom, but limits access solely to the lessee. This is not unlike many condominium properties, in which the owner owns the airspace within the walls of the condominium but the managing company owns the walls of the actual structure.

The push by the NRE advocates toward private leasing of oyster beds in the Bay is based

upon a number of economic studies showing greater financial returns being made on private oyster beds than on the public commons (Agnello & Donnelley, 1975, 1976; Alford, 1975; Christy, 1964; Powers, 1970). Given the apparently greater financial return from a private property rights structure, from an NRE perspective it would follow that if privatization has not occurred, it is because the transaction costs of achieving private property exceed the economic benefits. Yet, it is clear that there must be other factors at play since, in the Chesapeake Bay, common and private property (public and leased oyster beds) exist side by side. In addition, though Virginia also has common and private property existing side by side, its property rights structures are very different from Maryland's. In other words, with respect to the oyster grounds of the Chesapeake Bay, there is (a) the coexistence of common and private property, and (b) two states with very different property rights structures for the same resource.

Can the transaction costs of privatization or the value of the oyster beds be so different from one acre of oyster bottom to the next, or between oyster bottom in one state and oyster bottom in another state, to explain the failure to privatize all oyster bottoms? No, clearly transaction costs alone cannot explain the patchwork pattern of property rights to the oyster grounds. The property rights system in the Bay, Santopietro and Shabman (1992a) believe, is the result of a complex of factors that can best be explained by a more detailed historical perspective that includes a broad conception of the social values and concerns that have been associated with the oyster fishery. Santopietro and Shabman look at the reasons for the original creation and persistence of this mixed property rights system during the past 100 years, as well as draw implications from this history for the role of the social scientist in research and policy advising on oyster fishery management.

A Comparison with Oyster Farming Elsewhere in the United States

A growing industry. Aquaculture, or the farming of finfish and shellfish, is a growing industry nationwide. In the United States, controlled cultivation and harvest of fin/shellfish accounts for around 15% of fisheries production, and by the year 2000 that number is expected to rise to 20% (Leffler, 1988). Eventually, cultured production of finfish and shellfish could surpass harvests from the wild fisheries. The attraction to aquaculture is that it promises a more stable market and is less subject to cycles of boom or bust.

West Coast. In some states aquaculture is already far along. Virtually all oysters harvested in Washington state are the result of hatchery-produced seed and private planting. Oyster farming on leased and privately owned bottom has become a way of life in Washington, Oregon, and California since the 1800s. Like the New England and the Gulf Coast, the West Coast oyster fishery has faced overfishing, poor management, and pollution. In addition, particularly since World War II, there has been a shortage of seed oysters for oyster farmers. In other words, like the other parts of the United States, the history of the fishery followed a similar pattern: initial discovery of the oysters, followed by heavy harvesting, ineffective management to conserve and replenish them, and eventual depletion of the resource. However, that is where the similarity ends.

On the West Coast, the state governments did not step in to halt the decline. The opening of the transcontinental railroad in 1869 made it easier for enterprising fishers to bring oysters in from the East Coast and to transplant them on leased grounds. For a while it looked as if the Eastern oyster might replace the native Pacific oyster species. However, the Eastern oyster did not fare well. It did not reproduce well in the cold waters of the West Coast, and an increasing human population brought with it pollution and deteriorating water quality. So,

harvests fell and by the 1930s imports of Eastern oyster seed stopped (Leffler, 1987b). However, this did not put an end to the West Coast oyster fishery.

West Coast oyster farmers had already begun importing Japanese oysters (*Crassostrea gigas*) by the turn of the century. By 1919, the Japanese oysters had taken hold in Washington state and soon became the mainstay in Oregon and California. That was the beginning of an import industry that, until World War II, brought hundreds of thousands of bushels of Japanese oyster seed to oyster grounds on the West Coast.

Though oyster farmers did benefit from some natural spawning, water temperatures were generally too cold for the Japanese oyster to encourage a dependable natural set. West Coast oyster farmers had to continue to rely upon Japanese oyster seed, and, after World War II, imports of seed began again. However, with the rising price of seed, West Coast oyster farmers soon realized that what they needed was low-cost seed that could be produced on the West Coast. The time was ripe for hatchery technology, and enterprising oyster farmers embraced it. Since the hatcheries started, 90% of all the oyster seed planted on the West Coast has come from hatchery tanks (Leffler, 1987b). There are only a small number of hatcheries, owned by large integrated corporations, that supply the oyster seed for the entire West Coast fishery.

West Coast oyster fishers have been successful in growing the Japanese oyster because of their own entrepreneurship, and in no small part, because the Japanese oyster has generally been free of disease. So far, the West Coast fishery has not been plagued by anything such as MSX or Dermo. Planting oysters in the Chesapeake Bay as they have been planted on the West Coast may consequently be more challenging and require more work (LeGrand, 1997). In addition, by allowing large corporations to participate in the raising of seed and planting of oysters, a more stable economic base is available to withstand the ups and downs of the fishery. However, if the natural production in the Bay continues its downward spiral, the success of the

West Coast oyster industry may stand as an example of the way that the Bay's oyster fishery could have been managed, and lead to a change in management strategies.

New England. In the 1700s, the center of the American oyster industry was Connecticut. However, unregulated overfishing ruined the fishery in New England. By the 1800s oyster harvesting on public grounds had largely come to an end and was replaced by private leaseholds for oyster farming (Hedeen, 1986) on grounds rented from the state. Private leaseholds are not only the mainstay, they are the oyster fishery of New England today.

Having depleted their own stocks, dredge schooners began traveling to New Jersey and Virginia around 1808 to obtain oysters for the New England markets (Stevenson, 1894). By 1820, laws had been enacted in both Maryland and Virginia prohibiting both dredging in the Chesapeake Bay and transport of oysters from the state in ships not wholly owned for the preceding year by Bay residents. So not wishing to miss out on such a lucrative business, New England businessmen began establishing branches of their own oyster packing plants in Baltimore, Maryland, throughout the 1830s. With improved transportation systems such as the railroad and interconnecting state roads, New England packers were soon exporting increasing numbers of oysters, and then oyster seed, out of the state.

Although, as Caroline Wheal (1994) points out, fish farming is not the panacea to correcting badly managed wild fish stocks, aquaculture has been used successfully in New England for years to raise not only oysters, but salmon, carp, and shrimp. On one hand, Wheal believes, it is poorly placed faith in technology that encourages humans' firm convictions that technological solutions can always be substituted for dealing with the fundamental problem. However, on the other hand, aquaculture not only can take fishing pressure off the natural stocks, but allows the flexibility to move stocks to safer areas to avoid disease and maximize

survivability.

Delaware Bay. The natural shellfish growing areas of Delaware Bay are primarily along the Atlantic Coast of New Jersey and the New Jersey side of the Delaware Bay, with some shellfish beds on the Delaware side. Delaware Bay supports two commercially important molluscan species, Eastern oysters and Atlantic quahogs (*Mercenaria mercenaria*), also known as hard-shell clams. The commercial shellfish fishery of Delaware Bay began around colonial times and grew with the expansion of population centers around Wilmington, Delaware, as well as Philadelphia and New York (Weslager, 1967). Today, the quahog commercial industry remains high but, like in the Chesapeake Bay, overharvesting and disease have greatly reduced oyster harvests.

Also like the Chesapeake Bay, regulatory jurisdiction for the fisheries is shared by two states. As early as 1719 New Jersey passed legislation that prohibited the harvesting of oysters during the summer spawning season, and by nonresidents. This is the earliest recorded legislation in Delaware Bay designed to protect and enhance the resource (Ingersoll, 1881). In 1846, New Jersey passed much broader legislation that not only protected the natural resource by reiterating previous legislation, but it encouraged cultivation of oysters by legalizing and protecting the planting of seed oysters in creeks, ditches, and ponds (Bacon, 1903). The state of Delaware began enacting oyster fishery-related laws in 1812 by restricting harvesting to residents only and subsequent laws generally followed the management strategy laid out by New Jersey (Miller, 1962). In 1882 Samuel Lockwood (1882) surveyed the New Jersey oyster grounds for the state's Bureau of Labor and Industry. A few years later, Julius Nelson (1889) reported on the status of the oyster industry and came to the same conclusion, that the oyster industry had already severely depleted the natural beds and that the supply of oysters could be increased by

better husbandry of the resource and a greater reliance on cultivation rather than wild harvesting.

When oysters were first harvested commercially from the Delaware Bay, they were transported directly to Philadelphia by the same boats that harvested them, and most of the commerce was controlled by the Philadelphians. However, after the opening of the Chesapeake and Delaware Canal in 1829, oysters from the Delaware Bay were taken to Baltimore, Maryland, for shucking, canning, and shipment west (Ingersoll, 1881). In an attempt to preserve the resource, both New Jersey and Delaware passed legislation in 1856 that promoted oyster farming in Delaware Bay. Ten acre plots in areas rich in seed were leased to the highest bidder for periods of up to five years to promote planting and growth of oysters. In addition, fishing boats were assessed a licensing fee that was paid into an oyster fund that was administered by several commissioners and was expected to be used to enforce oyster laws and prevent theft. However enforcement, as in the Chesapeake Bay, was almost nonexistent.

To remedy the defects in the enforcement of the shellfish laws, New Jersey enacted legislation in 1871 that created the Maurice River Cove and Delaware Bay Oyster Association. The association was made up of licensed fishers and was intended to be self-governing. Boat and lease fees that were collected by the association were deposited into an oyster fund that was used to hire a watch boat and crew to patrol the leased oyster grounds. Since all members of the association had a vested interest in the oyster industry, it was expected that they would want to enforce the laws protecting it (Ford, 1994).

At the same time, the state of Delaware was trying to protect and encourage its oyster industry. So, in 1871 the Delaware side of the Delaware Bay was officially divided into upper bay public beds and lower bay planting grounds (Miller, 1962). Later, in 1873, an act was passed in the legislature that allowed anyone to stake up a one-acre plot of bay bottom for planting (Ingersoll, 1881). It also allowed for larger 15 acre plots to be leased from the state. No

leasing fees were charged for the one-acre plots. The only major restriction was that existing natural beds could not be leased or staked up. In contrast with New Jersey, fees collected from boat licenses and leases were paid directly to the state of Delaware, which administered and regulated the fishery (Ford, 1994).

By the first decade of the 20th century the oyster fishery was already well on its way to devastation. To add to the oyster fishers' problems several large grants containing natural oyster beds were sold, not leased, by the State Riparian Commission (Ford, 1994). Private ownership of producing seed areas by a few corporations threatened to displace hundreds of oyster fishers who had made their living tonging on what the state legislature itself had deemed public oystering grounds. Tempers flared and came to a head in 1907 during a violent clash between oyster fishers and guards hired by the Sooy Oyster Company, which claimed one of the riparian grants (New Jersey Bureau of Shellfisheries, 1908). In the end however, the grants were upheld.

On both sides of the Delaware Bay tensions rose because of the division between privately leased grounds and natural seed beds, which remained in the public domain. During the 1880s and 1890s, perceived encroachment on the public beds by planters who obtained riparian grants which extended into the bay, precipitated a bloodless oyster war (Hall, 1894). The conflict ended with New Jersey buying back the grants (New Jersey Bureau of Shellfisheries, 1906).

Between 1902-1905 the state of New Jersey assumed control of most of the oyster industry along the boardering Atlantic Coast. There were frequent conflicts reported between quahog fishers and oyster fishers, and between oyster fishers who wanted all areas open to public harvest and planters who wanted to lease acreage for private cultivation. At the time, tonging was the only legal harvest method. However, that was later to change. Seed oysters were in chronic short supply, and the cost of importing seed from the Chesapeake Bay and Long Island

Sound was prohibitively high for most small oyster farmers (New Jersey Bureau of Shellfisheries, 1912). But, with the outbreak of MSX in 1957, all imports and exports were banned (Ford, 1994).

Both the New Jersey and the Delaware oyster fisheries were devastated by the outbreak of MSX, but gradually the fisheries rebounded as the seed beds recovered in the late 1960s and early 1970s. In addition, it was determined that some of the native oysters developed some resistance to MSX as a result of natural selection (Haskin & Ford, 1979). Changes in oyster farming and harvesting practices added to the recovery. Before the outbreak of MSX, seed oysters were planted while small in size and remained on the leased grounds for 2 to 4 years before harvest. After MSX, even though the disease remained in some parts of the lower bay, the farmers learned to avoid areas of high disease incidence and sought oyster seed large enough to plant and market after only a single growing season, which minimized the time the oysters were exposed to infection.

The extent of the post-MSX recovery was not reflected in the harvest data because, as Haskin and Ford (1983) hypothesized, the return to profitability of an industry that was nearly lost encouraged substantial under-reporting of marketed oysters (subject to taxes). Although to this day the Delaware Bay oyster fishery has not reached pre-MSX harvest levels, the fishery is based entirely on seed grown in the Delaware Bay. In other words, although harvests do not equal those of earlier years, it should be emphasized that they are based entirely on native seed (Ford, 1994). Enforced harvest seasons on both sides of the bay and the introduction of culling machines also helped enhance the fishery. Before the outbreak of MSX, every time the seed beds received a heavy set, they were dredged out within 2 to 3 years. Hence, the strategy in recent years has been to restrict the harvest season and to close the beds if necessary, when the oyster population on a bed falls below 40% of its sustainable volume of oysters. With this plan,

oysters are spared to spawn for the succeeding generations.

After a modest come back, the Delaware oyster industry was dealt another blow in 1985, when severe drought (consequently raising salinities) accompanied a resurgence of MSX. By 1990, just as the fishery was rebounding a new problem surfaced, Dermo. Though Dermo was believed to have been introduced to the Delaware Bay back in the 1950s from seed imported from the Chesapeake Bay, Ford and Haskin (1982) believed that without warm enough temperatures and continued introductions, Dermo did not take hold at the time. The ban on imports succeeded in keeping Dermo in check but it is believed that it persisted in low incidence until the ideal conditions presented themselves in 1990 (Ford, 1992).

The Delaware Bay oyster industry faces an uncertain future. Some of the seed beds that provided oyster farmers with seed were closed for a number of years due to poor sets and to give the oyster population a chance to rebound naturally. In addition, the presence of MSX and Dermo makes the planting of seed in the more saline lower bay more risky (Ford, 1994). One thing to keep in mind that sets Delaware Bay oyster fishers and farmers far apart from Chesapeake Bay watermen is that neither the governments of New Jersey nor Delaware stepped in at any time to subsidize the fishery, by placing seed on public beds or anything else. Since this has been understood since before the turn of the century, Delaware Bay fishers have generally relied on other income, such as land farming, to supplement their earnings (personal communication, Dr. Susan Ford, Haskin Shellfish Laboratory, Port Norris, NJ, 1995). This has perhaps made it easier for the state governments to restrict the harvesting seasons or close the public beds entirely, since there is less reliance on the fishery than in the Chesapeake Bay. Currently, regulators, and government and university researchers are trying to encourage the industry to find new methods for farming oysters. At present, the only cost to oyster farmers for natural seed, exclusive of boat operating costs is a small licensing fee. Susan Ford (1994)

believes that until the cost of natural seed comes more into line with its true value, serious private investment in alternative methods for obtaining and culturing seed will not occur.

## Applying Research Strategies to the Study of Fisheries Management

### Applicability

While most research projects share five basic stages, they exhibit much diversity in the way in which these stages are carried out. Research projects can range from highly controlled experimental laboratory studies to uncontrolled observational studies. A paradigm can be the mental window through which the researcher views the world. What the researcher observes in a laboratory setting, in the social world, or when reviewing historical events is interpreted by her or his paradigm of concepts, categories, assumptions, and biases. Thus, two researchers describing the same thing from two different perspectives may produce considerably different accounts. Even the very problem that the researcher chooses to pursue is influenced by her or his values, methodology, and whether the study is to be conducted over time or at a single point in time (Bailey, 1994).

Research is never value-free and though researchers should try to avoid taking sides in their studies, it is perhaps more realistic to admit to some biases and to allow the reader to judge whether the presentation of the data/information is too one-sided. In contrast to many forms of evaluation in research, qualitative evaluation allows the researcher to focus on how things actually work rather than on whether they work (Taylor & Bogdan, 1984). The researcher can set aside official goals and objectives to explore what is really happening in an organization, program, or region.

The following discussion will consider the modified case study methodology and its appropriateness for studying fisheries in terms of the harvesting of shellfish, specifically oysters,

from the Chesapeake Bay and its tributaries, and various resource management strategies.

Qualitative Research

Qualitative studies are often conducted to explore a new area and develop a theory about it. But they are also designed to test and thereby confirm or disprove the theory. A qualitative study can be used to fill in the gaps of information that help explain the theory (Rein & Schon, 1977). Along this line, it is difficult to explain something unless one understands it. Therefore, the analytical progression should be constructed so as to formalize the elements of the story, locating the key variables, building a theory, and realizing how the variables are connected and influence each other.

After doing so the information must be presented or displayed in such a manner that the reader, policy makers, and so forth can draw valid conclusions and take appropriate action (Miles & Huberman, 1994). The format must always be driven by the research questions involved and the evolving concepts. Matrices are a popular form of displaying the crossing of two lists of information. If the focus on the study is understanding a chronology, then the matrix is time-ordered. This kind of display is particularly helpful for understanding the flow, location, and connection of events. It is also useful for exploratory scoping. Then it can lead to more causal explanations. With analysis and commentary attached, it can provide a good thumbnail sketch of the progress of change for use in the final report.

To do this one must reduce the data through a process of selecting, focusing, simplifying, abstracting, and transforming the data. Data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organizes the data in such a way that conclusions can be drawn and verified (Tesch, 1990). It is a form of data condensation. Once this is done the meanings emerging from the data have to be tested for their plausibility, their robustness, and their validity.

Without this, one is left with just a story of what happened, of unknown truth and utility.

Causal explanations are often erroneously assigned to random events believing that the events are systematic, ordered, and real rather than random, chaotic, and illusionary (Gilovich, 1991). Causality decisively brings in the question of time. In other words, what sequence of events caused the present circumstances. Prior events are assumed to have some connection with following events (Kim, 1981), even though the connection may not be neat and clear. The deductive researcher starts with a preliminary causal network, and the inductive researcher ends with one (Wolcott, 1992). Drawing conclusions from the network goes along with its production. It is important to specify which decision rules are employed in the construction of the network.

The Case Study

While the ever popular survey is extensive and cross-sectional, a case study is intensive and longitudinal, carefully analyzing a single case or a limited number of typical cases. A case may be an individual, a type, a group, a region, or an institution. The analysis is detailed, noting change, growth, or development in the life cycle (or an important part of the life cycle) of the case under consideration. The distinctions between a survey and a case study are, realistically, meant purely as points of reference. In truth, many research studies exhibit characteristics of both the survey and the case study thereby making any classification difficult (Yin, 1994).

Case studies are generally preferred when the why or the how questions are being posed and particularly when the researcher has little or no control over events and when the focus is on contemporary phenomena with a real-life context. Of greater advantage here, when investigating events leading to current practices in natural resource management, is that a case study approach does not depend solely on participant-observer data. This approach generally begins with a

thorough review of the literature on the topic to examine events leading to the present situation (Cooper, 1984). The disadvantage to this approach is that too much information, generally from secondhand and thirdhand sources can lead to long, unwieldy write-ups (Feagin, Orum, & Sjoberg, 1991).

When the focus of attention is directed toward a single case or a limited number of cases, the process becomes personalized. The case study is concerned with everything that is significant in the history or development of the case. The purpose is to understand the life cycle, or an important part of the life cycle, of an individual unit. This unit may be a person, a family, social group, community, ecosystem, institution, or geographic region. The case method probes deeply and intensively analyzes interaction between the factors that produce change or growth. It emphasizes the longitudinal approach thereby showing development over a period of time. This is an important fact for a common flaw is to consider the case study as merely the exploratory stage of some other type of research strategy (Hoaglin, Light, McPeak, Mosteller & Stoto, 1982).

In social work or psychiatry the term case study usually assumes a more limited meaning. In this context emphasis is placed upon the study of an individual person for the purpose of diagnosing her or his problems and recommending remedial measures for her or his rehabilitation. Here the emphasis is not upon the individual representing a type but upon the individual as a unique personality, with her or his own constellation of problems and needs. Ordinarily, the social work or psychiatric case study is not research oriented but is directed toward the solution of an individual's problems. A study of a number of these individual cases can be expanded into a research project particularly where the typical aspects of each case are contrasted or compared for the purpose of arriving at a greater understanding of human behavior or for the purpose of discovering new generalizations (Best, 1970; Yin, 1994).

Community studies are a specialized type of case study where the community serves as

the case under investigation. A well-conducted community study is a careful description and analysis of a group of people living together in a particular geographic location in a corporate way. The community study can deal with such elements of the community as location, prevailing economic activity, climate and natural resources, historical development, how the people live, the social structure, life values and patterns, people or factors that exert the dominant influence and the impact of the world outside the community on the community (Yin, 1994). This can be particularly useful when examining the connection between a fishing community and the state of the fishery.

A case study is an empirical inquiry that not only looks at contemporary issues within a real-life context but permits investigation even when the boundaries between phenomena and context are not clearly evident. In contrast, an experiment deliberately separates a phenomenon from its context so that attention can be focused on only a few variables. It is a more controlled study, such as in a laboratory in which the investigator can control the conditions (Yin, 1994). By further comparison, a history does deal with the entangled situation between phenomenon and context, but usually with noncontemporary events (Horwich, 1993). Surveys, on the other hand, can try to deal with a phenomenon and context, but their ability to investigate the context is extremely limited.

A case study, particularly one involving natural resource management, is a useful tool in that it allows the investigator to deal with a technically distinctive situation in which there may be more variables of interest than data points. A case study relies on multiple sources of evidence with data needing to converge in a triangulating fashion, and often benefits from the prior development of theoretical propositions to guide data collection and analysis (Andersson, 1994).

There are four dominant analytical techniques for case studies: pattern-matching,

explanation-building, time-series analysis, and program logic models. Any of these techniques are applicable to both single- and multiple-case studies. For case study analysis, one of the most desirable strategies is to use a pattern-matching logic. Such a logic compares an empirically based pattern with a predicted one or with several alternative predictions (Trochim, 1989). If the patterns coincide, the results can help a case study strengthen its internal validity. If the case study is an explanatory one, the patterns may be related to the dependent or independent variables of the study, or both. For example, if one were trying to determine whether the decline in the population of fish within a fishery was caused by disease, one would try to match the pattern of decline in population numbers with the increase in disease incidence. The inference here is that the decline in one is dependent upon a rise in the other (Cook & Campbell, 1979). A second type of pattern-matching is that for independent variables. The same outcome may be known to occur in several cases but the how and the why this outcome occurred needs to be investigated. This analysis requires the development of rival theoretical explanations that each involves a pattern of independent variables that is mutually exclusive. In other words, if one explanation is to be valid, then the others cannot be valid. This means that the presence of certain independent variables precludes the presence of other independent variables. With a single-case study, this can mean that the successful matching of the pattern to one rival explanation was the correct one and that the other explanations are incorrect. To explain a phenomenon is to stipulate a set of causal links about it. These causal links are similar to independent variables. In most cases, particularly in natural resource management studies, the links may be complex and difficult to measure in any precise manner.

Case studies have several applications in evaluating events or phenomena, such as in natural resource management. One of the most important is to explain causal links in real-life interventions that are too complex for survey or experimental strategies (Cronbach, 1980; Guba

& Lincoln, 1981; Patton, 1980; Yin, 1993) . In other words, the explanations could link resource management strategy implementation with effects on the resource. A case study allows the investigator to draw inferences concerning causal relations among the variables under investigation and defines the domain within which generalizations to a larger population or different situations can be made (Nachmias & Nachmias, 1992).

As mentioned above, one of the ways in which inferences can be drawn is from pattern-matching, whereby several pieces of information from the same case may be related to some theoretical proposition (Campbell, 1975). It is essential, however, that theory development be part of the early design phase of a case study before any criteria or methodology such as pattern-matching can be used to interpret the data, whether the ensuing case study's purpose is to develop or test a theory. Theory development not only facilitates the data collection phase of a case study but an appropriately developed theory is also the level at which generalizations of the case study results will occur (Yin, 1994).

The essential logic underlying a time-series design is the match between a trend of data points compared with a theoretically significant trend specified before the onset of the investigation versus some rival trend (Yin, 1994). The analysis of chronological events is a frequently used technique in case studies and may be considered a special form of time-series analysis. The chronological sequence allows the investigator to trace events over time. The arraying of events into a chronology permits the investigator to determine causal events over time because the basic sequence of a cause and its effect cannot be temporally inverted. However, unlike the more general time-series approaches, the chronology is likely to cover many different types of variables and not be limited to a single independent or dependent variable. On those occasions when a time-series analysis is relevant to a case study, an essential feature is to identify the specific indicator(s) to be traced over time as well as the specific time intervals to be

covered. Only as a result of such prior specification are the relevant data likely to be collected and analyzed.

Building validity into a case study, internal or external validity, is probably one of the most difficult things to do. Internal validity, in particular, is a concern for causal or explanatory case studies in which the investigator is trying to determine whether event *A* led to event *B*. If the investigator incorrectly concludes that there is a causal relationship between events *A* and *B* without knowing that some third factor, event *C*, may actually have caused event *B*, the research design has failed to deal with some threat to internal validity (Campbell & Stanley, 1966; Cook & Campbell, 1979). The concern over internal validity for case study research may be extended to the broader problem of making inferences. A case study involves an inference every time an event cannot be directly observed. Thus the investigator will infer that a particular event resulted from some earlier occurrence, based on interviews and documentary evidence collected as part of the case. This is particularly troubling when dealing with natural resources (living things, ecosystems) in that not all the contributing factors to an event may ever be known and factors not apparently directly or logically related to an ecosystem, such as politics, may have a great influence on the outcome of events.

Another problem, which deals with the external validity of a case study, involves knowing whether a study's findings can be translated into theories or models applicable beyond the immediate case study. For example, are the factors influencing the decline of the Chesapeake Bay oyster fishery the same as the causes for the decline of fisheries elsewhere or are they specific to the Chesapeake Bay? Are the social and political factors affecting the Chesapeake oyster fishery unique to Maryland and Virginia or are they common to fishing communities in general?

One reason that a single-case study design may be preferred at times is that it can be set

up to test a well-formulated theory that has specified a clear set of propositions as well as circumstances within which the propositions are believed to be true. Selected subunits within the study can be used to focus a case study inquiry such as harvest data or disease incidence (Yin, Bateman, & Moore, 1983). Within a single case may be incorporated subunits of analyses so that a more complex design is developed. The subunits can often add significant opportunities for extensive analysis, enhancing the insights into the single case. However, if too much attention is given to these subunits, and if the larger, holistic aspects of the case begin to be ignored, the case study itself will have shifted its orientation and shifted its nature.

One of the main reasons that people chose comparative or multiple-case studies over single-case studies is that the evidence from multiple cases is often considered more compelling and the overall study is therefore considered more robust (Herriott & Firestone, 1983). A case is generally about what has already occurred or leads up to what is occurring now. Therefore, it is left to the investigator to make inferences about what actually transpired. The inferences, in turn, are based on convergent evidence as well as on an unmeasurable amount of common sense. When the inferences are made on multiple cases to determine whether there is a common thread or connection then this is similar to the replication logic that underlies multiple-case studies (Abbott, 1992).

Sometimes two variables are negatively correlated. When a large variable is associated with a small variable, then as one increases the other decreases. When the relationship between two variables is a pure chance relationship, then it is said that there is no correlation between the two (Miles & Huberman, 1994). One of the most important applications of correlational analysis is that of prediction. When the relationship between two sets of variables has been established, it is possible to make predictions about one of the variables from a knowledge of one of the others. A case study approach can include both single and multiple case studies and when multiple cases

are involved this approach is called a comparative case study (Agranoff & Radin, 1991; George, 1979; Lijphart, 1975).

When collecting the data for a case study, single- or multiple-case, the evidence may come from six sources: documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. Special attention needs to be paid to the chain of evidence that may provide explicit links between the questions asked, the data collected, and the conclusions drawn. The use of multiple sources of evidence allows the investigator to address a broader range of historical, attitudinal, and behavioral issues that have clearly become key factors in resource management studies. The most important advantage to using multiple sources of evidence is the development of converging lines of inquiry, which is a process of triangulation (Patton, 1987). With triangulation, the potential problems of construct validity can also be addressed because the multiple sources of evidence essentially provide multiple measures of the same phenomenon (Yin, Bateman, & Moore, 1983).

The following will provide a description of the characteristics of historical research methodology and causal comparative research methodology combined into a case study with commingled research strategies, and their advantages and disadvantages, particularly as they relate to the study of natural resource management strategies and specifically to fisheries. The harvesting of natural resources such as finfish and shellfish from oceans and lakes on a commercial level has many dependent industries associated with it including packing and canning, transportation, marketing, and restaurants. The discussion that follows will consider the modified case study methodology and its appropriateness for studying fisheries in terms of the harvesting of shellfish, specifically oysters, from the Chesapeake Bay and its tributaries, and various resource management strategies.

# CHAPTER 3

## Methodology

### Causal Comparative Research Design

#### Scoping a Research Strategy

The Maryland oyster fishery is in itself a study of science conflicting with politics, and culture conflicting with sustainable fishery practices. Within the framework of a causal comparative research design, fisheries management strategies were examined to determine how, or if, they addressed politics and culture within their own setting and time, and how their successes or failures could be applied to, or avoided by, the Maryland oyster fishery. The contributing and restraining factors, and the determinants and consequences, of all the fisheries management strategies investigated were used to glean a workable strategy(ies) that could be tailored to the needs of Maryland's oyster fishery, today and in the future.

Causal comparative research is a type of descriptive research that seeks to find the answers to problems through the analysis of causal relationships. What factors seem to be associated with certain occurrences, conditions, or types of behavior? Since it is often impractical to arrange occurrences, an analysis of what actually does happen is the only feasible way to study causation. By the method of descriptive research an attempt is made to find the factor or factors associated with certain events (Best, 1970).

One of the dangers of causal comparative research is the post-hoc fallacy, in other words, to conclude that because two factors occur simultaneously, that one is the cause and the other the effect. While conducting this case study using causal comparative research, an attempt was made to single out the really significant causal factor(s) and yet recognize that events often have multiple rather than single causes. It was important not to base conclusions on a too-limited number of occurrences or fail to recognize that factors may go together without having a cause-effect relationship, thereby leading to false or misleading conclusions. In scientific inquiry, one

must learn to recognize as causes what have ordinarily been taken to be effects (Horwich, 1993; Andersson, 1994). To illustrate, one can ask the question, what is responsible for the decline in the oyster population? Is it overharvesting, disease, or pollution? Do each of these factors contribute to the decline independently or are they interrelated or are they coincidental?

In order to conduct inter- and intra-regional research there was a need to incorporate more than one of a wide range of methodologies and disciplinary traditions to study comparative issues, such as the significance of different forms of fisheries management strategies on the private and the public oyster fisheries. Interregional comparisons were used to advance substantive and methodological knowledge in fisheries management. The advantages of combining several research strategies into a case study approach when examining natural resource management, were that the evidence could be examined as a network of implications, comparisons could be made with other strategies and, as with all living systems, conclusions could be drawn with the understanding that the influencing factors are ongoing and ever changing.

Comparative research can be and was employed in an interdisciplinary fashion to address the causal as well as historical factors that contribute to the cultural, political, economic, and ecological characteristics of regions to formulate practical resource management strategies for a sustainable future.

## A Historical Perspective

Causal comparative research methodology is a highly adaptive tool for studying resource management strategies and comparing institutional structures, whether they are government or private enterprise. It is necessary, however, to incorporate a historical perspective into one's research design when studying ecosystems and living organisms. Whatever changes take place

within an ecosystem, be they small or large, transient or long-lasting, they will take place in graduated steps over time through a highly interactive matrix of feed-back mechanisms.

Historical research describes what was. The process involves investigating, recording, analyzing, and interpreting the events of the past for the purpose of discovering generalizations that are helpful in understanding the past and to a limited extent, in anticipating the future.

Historical records provide a meaningful perspective on the achievements or failures of particular resource management strategies. History can also serve as a record of Mother Nature's struggles, triumphs, and failed battles. Extinct species, habitat alteration, and changes in harvesting/fishing practices are the symptoms, causes, or results of what was in ecological history. The history of a fisheries is not merely a list of chronological events but an integrated account of the relationships between resource management strategies, naturally occurring events, times, and places.

By incorporating a historical perspective into a comparative analysis of oyster fisheries management strategies between the private and the public fisheries of Maryland as well as other regions of the United States, it is hoped that a greater understanding of the present was achieved as well as gaining the ability to plan for, or predict, future resource management strategies and their outcomes (Felt, 1981).

Barzun and Graff (1970) suggest that there are two popular ways to write about historical trends, in chronological order or by topic. The fault of the strict chronological order is that it mixes events great and small without due subordination and that it combines incidents that occur only once with permanent truths about habits and tastes, character, and belief. However, strict topical order entails a lot of repetition of shared chronological events and does not leave a clear portrait. It appears, therefore, that the best way is to combine the topical and chronological arrangements. In the combined form, the chronology moves forward within each topic, giving an

occasional backward or forward glance as needed.

A historical perspective has generally been a relatively small segment of causal comparative research but is gaining popularity in environmental and ecosystem research. When it is feasible, there are obvious advantages to a historical perspective. Historical trends in a fisheries can serve as an effective complement to causal comparative research by documenting surrounding and contributing historical events. Further, if one is interested in learning how some contemporary situation, such as the decline of a fisheries, came into being or explore the efficacy of a resource management strategy, a historical approach is indispensable. Historical studies tend to be qualitative or humanistic rather than quantitative. In environmental research, if, for example, one is examining fisheries management strategies, it is appropriate if not desirable to include numerical data such as yearly harvests or viable habitat.

A Resource Management Orientation

Natural resource management must contend with the biological and reproductive patterns of the resource, politics, and culture. Therefore, it is within this matrix that a natural resource management strategy is evolved and executed. Awareness of the cultural influences, hidden political agendas, and socioeconomic values lead to a better understanding of why certain resource management decisions are made in seeming contrast to the science of the natural resource.

Resource management is both a social institution and a biological science institution and can therefore be viewed as having evolved out of compromises with individuals and groups which may have different perceptions, attitudes, values, goals, and interests. Add to this the somewhat unpredictable responses of living organisms, such as oysters and the other living organisms on which they depend, to their environmental conditions, both human-influenced and

natural (Nelson, 1990). Therefore, resource management and changes in resource management strategies must be treated not as inert machinery that can be readily manipulated to bring about the resolution of declining harvests or achieve sustainable yields for a limitless future, but as a social, biological, living entity.

The workings of resource management as an institution and their influence on the survival of the resource, such as an oyster fisheries, are legitimate focal points for inquiry that were integrated with the overriding concern in resource management with understanding the changing environmental and economic conditions in which people live, regionally and globally.

Comparative methodology has been used more recently to compare a broad range of subjects beyond the humanities and social sciences. The following are a number of ways in which comparative methodology was used to approach a wide variety of issues associated with fisheries resource management:

1. Rethinking relationships between economic, political, and environmental transformations across and between regions. Comparative research was used to better understand the range of options available to promote sustainable resource development and fisheries management in different settings and to clarify the nature of the processes that are underway and to analyze the constraints and opportunities that they introduce.

2. Comparative perspectives on the socioeconomics of sustainable fisheries development.

A deeper understanding framed in specific comparative terms is useful to examine the causal links between regional fisheries management patterns and cultural variations related to occupational traditions and practices. Conceptual and empirical findings can be used to build bridges between these domains, and influence public policy and fisheries resource management strategies in different cultural contexts.

The problem of generalization and prediction in fisheries management is of particular concern for two reasons (a) one is concerned with the problems of economic development and environmental change in the contemporary world, and (b) unraveling the contributing sociopolitical and socioeconomic factors that influence the resource management strategies and how they are implemented is daunting. These reasons are part of the challenge to both environmental and social researchers alike to describe and explain the present conditions, as well as predict events and conditions of the future.

In comparative research, causal inference is the process of reaching the conclusion that one set of events, either directly or indirectly, brought about present conditions. In the case of the efficacy of a fisheries management strategy, it may be concluded that a particular set of events weighs more heavily than others as the cause of the present state of the fisheries. However, as was the case with the Maryland oyster fishery, it could not be proven that any one event, decision, or strategy was the cause of the present situation. But it was necessary to be aware of the assumptions that underlie the inferred cause of a sequence of events.

While making regional comparisons, it was essential to distinguish between causal relationships in which changes in one variable produce changes in another variable, and correlational relationships in which the values of the variables are linked and change together, but it is not implied that change in the value of one variable causes changes in the value of another (Bordens & Abbott, 1991). When explanations are first developed for observed phenomena, knowledge of observed relationships can serve as an important guide, even if it is unknown which relationships are causal and which are correlational. Distinguishing between causal and correlational relationships is thus an important part of the research process, particularly in the hypothesis testing phase. However, the ability to distinguish causal from correlational relationships varied with the amount of information that was available to be

gathered on the variables in the study.

For example, it was discovered that sustainable oyster harvests occur in parts of the United States that have a high number of privately leased oyster beds. So, the Maryland harvest data were examined over a period of time and clues were sought as to the possible causes of differences between the regions of the United States with a high number of privately leased beds and Maryland, with its high number of public beds. In the process it was discovered that there have been, and are, differences in the fisheries regulations and/or regulatory leasing incentives, the allowable method of harvest, the regulated length of the harvest season, the incidence of disease, impact of pollution, degree of habitat destruction, and weather. With several research questions in mind, the past fisheries management strategies of the different regions were examined, searching for cause-effect relationships for each region and then making a comparison.

Margaret McKean (1992) believes that the notorious tragedy of the commons is incorrectly held to be the eventual fate of all natural resources that are used collectively rather than by individual, private owners. She demonstrated that a comparative analysis of successful and unsuccessful collective management strategies of natural resources within the institutional regimes that have operated for decades or even centuries can be used to explore the features shared by historically unconnected institutional regimes in order to begin specifying the characteristics of regimes that circumvent tragedy. She identifies that successful systems usually have well-defined communities of eligible user-managers and clear, easily enforced and environmentally cautious rules to constrain resource use. But they vary greatly in terms of the allocation of the harvested supply of the resource, from hierarchical systems of rights with unequal allocation of the resource to very egalitarian systems that assign equal shares by lottery.

Increasingly, communities and societies across the globe are confronting unprecedented

changes in the character and scope of the underlying processes that shape social and cultural life (Hershberg, 1992). In the past, geographic boundaries provided an organizing principle through which researchers could interpret distinctive cultural, social, political, and economic behaviors and institutions. Research was conducted within geographic areas to make comparisons across these areas to explain similarities and differences. Research in this tradition remains essential to the development of knowledge but, according to Hershberg, it is no longer sufficient since critical forces now shaping institutions and behaviors are not rooted in territorially-defined areas. Rather, they involve a multiplicity of processes that originate outside of, and often transcend, geographical boundaries. Fisheries markets contract and expand and the systems of production and exchange which cause them take place on a global scale and elicit overlapping policy responses in highly divergent contexts. Similarly, changes in the natural environment are experienced by citizens and governments on a global scale and have led to widespread experimentation with new regulatory practices and with innovative forms of resource management.

Implementation and Validation

A study of causal relationships from the past to the present was used to understand past resource management strategies and to try to understand the present conditions in light of past events and developments. This analysis was directed toward the private and public oyster fisheries of the Maryland portion of the Chesapeake Bay, but in fact encompasses a whole ecosystem, many resource management strategies, their acceptance by regional oyster fishers, and whether successful alternatives are available. None of these could be examined in isolation for there is a great deal of interaction between them. In this study, the oyster fisheries of the Chesapeake Bay refers to the commercial harvest of the only indigenous species of the region,

*Crassostrea virginica*, commonly referred to as the Eastern oyster, Atlantic oyster, New England oyster, Malpeque oyster, Chesapeake oyster, and other regionally-connected names.

The major difficulty involved in this process was delimiting the problem so that a satisfactory analysis was possible. According to Best (1970), too often the problem is stated too broadly, when what is needed is an in-depth analysis of a limited problem, rather than involving only a superficial examination of a broad area.

Carl Kaestle (1992) raises the issue of how information that is gathered to address proposed hypotheses can be presented as the truth and with certainty. For now, even the truths of the physical and biological sciences are seen as relative and impermanent. If the issue is certainty then, Kaestle asks, certainty about what kinds of issues and for whom? It is not hard to find consensus on many low-level matters which can readily be called factual. On the other hand, the more significant and interpretive the generalization, the less certain one can be about it. Kaestle summarizes by saying that truth is plural, relative, and tentative on issues of importance.

There is an ethical principle common to all good work in history, whether the work be collecting, analyzing, editing, or writing history. It is not just the principle of respect for the truth, but of respect for the whole truth. In practical terms, respect for the whole truth means making an honest appraisal of all the facts and interpretations one has found up to the moment. Sentimentality, poetic nostalgia, pride, whimsy, and wishful thinking all have their place and a place should be kept for them, but not in history, unless they are labeled and treated as what they are (Felt, 1981). Many so-called historical reviews have been published in North America on the lives of fishers, then and now. These books and articles tend to be nostalgic and romanticize the independent nature and hardships of fishers while glorifying their existence. These make wonderful reading but are unreliable in practical terms. James Michener's *Chesapeake* (1978), a classic in its own time, and his *The Watermen* (1979) are examples of many fictional tales that

have drawn on the Chesapeake Bay's history. It is particularly confounding when the very practices that are romanticized are the ones that may lead to the demise of entire fisheries.

An important point that Bronowski (1963) makes is that the key to the actions of living things is that the actions are directed toward the future. The condition for the survival of living things, individually and as a species, is that unless they can adapt themselves to the future and interpret signals in advance, they will perish. There is a relationship between the past, present, and future. This is particularly germane as one observes the decline of ecosystems.

People use history to understand the past and to try to understand the present in light of past events and developments. Historical analysis may be directed toward an individual, an idea, an ecosystem, a movement, a location, or an institution. None of these can be examined in isolation for there is a great deal of interaction between them. The subject or focus merely determines the point of emphasis toward which the historian directs her or his attention (Strauss, 1995).

The case study is concerned with everything that is significant in the history or development of the case. The purpose is to understand the life cycle, or an important part of the life cycle, of an individual unit. This unit may be a person, a family, social group, community, institution, or geographic region. The case method probes deeply and intensively analyzes the interaction between the factors that produce change or growth. It emphasizes the longitudinal approach thereby showing development over a period of time.

Historical and current information and data on Maryland oyster harvests in the Chesapeake Bay was collected, distinguishing between the public and private oyster fisheries, to the extent that it was possible. The data/information gathered and a description of the prevailing conditions or practices associated with oyster fisheries management strategies was organized and analyzed so that conclusions could be derived. These conclusions were based upon comparisons,

contrasts, or causal relationships of specific resource management strategies within and between the Chesapeake Bay and other parts of the United States.

According to John Best (1970), causal comparative research may be used in problem solving, and in solving a problem or charting a course of action several types of information may be needed. That was certainly the case for the Maryland oyster fishery. The types of information needed for this study follow:

1. Historical and current Maryland oyster harvest data. Historical and current data on Maryland oyster harvests were collected, distinguishing between the public and private fisheries, to the extent possible.

2. Virginia harvest data. Oyster harvest data from Virginia, which is also a part of the Chesapeake Bay, was collected, compared, and contrasted with Maryland's harvests.

3. Past and prevailing conditions or practices. Information was gathered and a description of past and prevailing conditions or practices associated with oyster fisheries management strategies was analyzed, compared, and contrasted, within and between the Chesapeake Bay (Maryland and Virginia) and other parts of the United States. It was particularly important to assess and compare the oyster fisheries management strategies of Virginia and Delaware Bay since these fisheries involve not only the same species of oyster, but are geographically close and are subject to the same problems, such as disease and pollution.

4. Property rights schemes. Information on the different property rights schemes used in fisheries management strategies in fisheries that are generally accepted as successful were analyzed, and compared and contrasted between each other, and with Maryland.

5. Influences on fisheries management strategies. Information on what types of regulations, incentives, disincentives, political factors, values systems, and social norms affect oyster fisheries management strategies were collected and analyzed.

6. Experiences of oyster fisheries managers and researchers. Oyster fisheries managers and researchers around the Chesapeake and Delaware Bays were contacted to learn first hand from their experiences and in-sights in the field. Their practical knowledge and perspectives were integrated into an analysis of the present state of the oyster fishery and the potential viability of alternative fisheries management strategies in Maryland's oyster fishery.

Some research studies emphasize only one aspect of problem solving while others may deal with two or more of the elements. Although a research study does not necessarily embrace all the steps necessary (they may not be known) for the solution to the problem, it may still make a valuable contribution by clarifying only one of the necessary steps, from the description of the present status to the charting of a path to the goal.

One of the problems inherent in trying to assess the efficacy or even the success or failure of an oyster fisheries management strategy was to find a nominal form of measurement by which to (a) analyze efficacy, (b) make comparisons between strategies, and (c) make comparisons between the private and public fisheries.

According to Bailey (1994), all qualitative measurement is nominal, regardless of whether the categories are designated by names or numerals. Nominal measurement is essentially a classification system. Basically all that is required of a nominally measured variable is that there be at least two categories and that they be distinct and mutually exclusive.

It was important to be clear about what kind of information or data were being compared so that the credibility and validity of the analysis of efficacy, and the comparison between regions could be judged. The success of an oyster fisheries or the efficacy of a management strategy is measured in terms of sustainability (equal or greater harvests on successive years), while harvests are measured and compared in bushels per year (bu/yr) or number of viable (producing) oyster beds and their size.

It is important to explain how the data presented were gathered and interpreted so that they can be understood in context. For example, total harvest numbers alone do not reflect whether there were low harvests on multiple oyster beds or high harvests on a small number of beds. Additionally, without this explanation it would be difficult to know whether the findings came from cultural knowledge, prior theoretical frameworks, direct personal experience, or actual fieldwork. Such explanations therefore made it possible to judge the credibility and validity of the information.

Without these types of analyses, it would have been difficult to judge whether, for example, the concept of harvesting from privately leased beds is a successful fisheries management strategy over the everyone-for-themselves harvesting from public beds indicative of the law of the commons. If the general hypothesis that regions in which public (state managed) oyster beds are predominant suffer from overharvesting, destruction of habitat, and reduction of viable stocks for continuing sustainable yields is assumed to be true, then why is there not a preponderance of privately leased beds throughout the Chesapeake Bay? This introduces the second part of this study and the most difficult to analyze and compare. What variables exist/existed that influence the number and size of privately leased beds and their harvests, the regulatory incentives or disincentives, or acceptance by the watermen?

Particularly worthy of mention was the utility of comparative methodology, including interregional comparisons, to explain variations in phenomena in different settings, to identify distinctive responses to transregional processes and ultimately, to produce generalizable propositions about the nature and consequences of these phenomena.

Researchers in transregional or transnational research often need to incorporate more than one of a wide range of methodologies and disciplinary traditions to study comparative issues, such as the significance of different forms of fisheries management strategies on

environmental and commercial sustainability or degradation. Interregional comparisons can be used to advance substantive and methodological knowledge in fisheries management.

Historical research can be described as the systematic search for documents and other sources that contain facts relating to the historical researcher's questions about the past. By studying the past, the historian hopes to reach a better understanding of present sociopolitical conditions, management practices, and ecological problems in natural resource management. In the last century, the popular view of historical research was a chronological compilation of events. A more contemporary approach tends to subordinate historical facts to an interpretive framework within which they are given meaning and significance.

Though Taylor and Bogdan (1984) describe the characteristics of historical research, and specifically a life history, in terms of sociological research and an individual's life history, the concepts can be applied to a geographic region's life history. A life history contains a description of the important events and experiences in the life of a region. As a potential environmental management/planning document, a life history can be constructed to illuminate the significant features of a region's life, such as a fishing community. The concept directs one's attention to the fact that people's definitions of a region, themselves, and others are not unique but rather follow a standard and orderly pattern. The definition of a fishing community can be defined in people's eyes in terms of place, an economic resource, or a recreational area. In putting together a life history, one tries to identify the critical stages and period's in a region's life that shape its definitions and perspectives (Strauss, 1995).

Comparative research is useful in that it can be used to better understand the range of options available to promote sustainable development and resource management in different settings and to clarify the nature of the processes that are under way and to analyze the constraints and opportunities that they introduce. Cultural dimensions of human conflict,

including disputes, are rooted in ethnic, political, racial, or religious differences. Comparative research can be used to examine how collective identities are formed through shared patterns of cultural expression, interpretations of shared traditions, and common experience. Comparative research can be employed in an interdisciplinary fashion to address the causal as well as historical factors that contribute to the cultural, political, economic, and ecological characteristics of regions to formulate practical strategies for a sustainable future.

According to Holt and Turner (1970), the logical consequences of a theory are verified, not the theory itself, in comparative research. Since it is only possible to observe particular facts, then only the particular consequences of a theory can be verified. In principle, there is not any difference between comparative cross-regional research and research conducted within a single region. The differences rather, lie in the magnitude of certain types of problems that have to be faced. Holt and Turner believe that often much of comparative research is not oriented toward hypothesis testing at all, but is exploratory in nature and is undertaken to aid in the development of hypotheses. But regardless of how the research questions have been derived, a major purpose of much of the research is to identify the relationships between the variables.

Resource management, whether it be implemented through regulatory action, incentives, or otherwise, is inescapably burdened by politics. Though political leaders profess to find historical trends the best guide to action and say that history moves minds by what it inspires, some politicians have not hesitated to admit their desire to influence events by proving the rightness or wrongness of a cause out of its historical antecedents.

## An Environmental Ethics View

Mark Sagoff (1992) provides an insightful look at the way in which resource managers should address ecological communities and systems when examining and comparing resource

management strategies. Unfortunately, as Sagoff points out, it is generally believed that there must be hard scientific reasons to justify environmental management decisions that may be based on moral and aesthetic values. If one is to accept the idea that ecosystems may be objects not only of use but also of aesthetic appreciation and moral attention, then one must accept the possibility that these systems have a good of their own that should be respected and therefore, protected. It should not take the hard facts of the decline or mismanagement of a natural resource to provide a reason for doing what is morally correct.

Rushworth Kidder (1995) suggests that it is easy to choose between right and wrong, but increasingly ethical dilemmas force people to choose between right and right. Rapid changes in society, technology, and global relationships are increasing the number and intensity of ethical dilemmas facing resource managers as they enter the 21st century. Research into resource management strategies today and in the future cannot ignore this dilemma and in addressing this dilemma, the need to assess the alternatives and rank the consequences. There is a need to be ever mindful that the so-called obvious answer to a resource management problem is not so clear and should include a weighing of two needs and their two appropriate management strategies.

The concept of resource management as a scientific and communicative process manifests itself in the view that institutional arrangements are value-neutral instruments of public policy in both policy formulation and in regulatory enforcement. The notion that science drives policy remains firmly, if not naively, entrenched as the mainstream philosophy of resource managers, planners, and economists (Friedmann, 1987). This view persists despite obvious practices and implementation to the contrary, because it serves as a tool to advance otherwise unpopular regulations and processes and it appears to put into simple straight forward terms what would seemingly come across as a complex matrix of confounding rhetoric. The importance of the institutional arrangements of resource management as being culturally and politically

influenced should not be lost on the resource manager.

## Commingling Research Methodologies

One of the primary tasks of historical research concerns investigating the causes of past events. What were the forces and events that brought about the conditions of today? Specifically, for one who is examining the success or failure of a fisheries management strategy, one would wish to go back in history to analyze the causes of a decline, increase, or maintenance of a sustainable level of harvest, and then compare the historical causes and the present conditions to a similar fisheries elsewhere. When studying living systems, like a fisheries for instance, that involve an entire ecosystem of interdependent plants and animals, weather, interactions with humans, including the consequences of regulatory legislation and resource management strategies, one must always be aware that changes, such as a decline or a rise, do not happen overnight. Therefore, events of the near or distant past can have profound and far-reaching effects on the present state-of-affairs and on into the future.

Causal inference is the process of reaching the conclusion that one set of events brought about the existing conditions, either directly or indirectly. In the case of the decline of a fisheries one might conclude that a particular set of events may weigh more heavily than others as the cause of the present state of the fisheries. It is unlikely that the researcher can prove that one event, decision, or strategy is the cause of the present situation however, she or he can be aware of the assumptions that underlie the inferred cause of a sequence of events. In making causal inferences the researcher should be aware of her or his assumptions about the causative factors sometimes used to explain occurrences in another point in time. However, it is also likely that the more researchers know about the antecedents of a historical event, the more liable they are to discover the possible causes of the event.

When making regional comparisons, one must be careful to distinguish between causal relationships in which changes in one variable produce changes in another variable, and correlational relationships, in which the values of the variables are linked and change together but it is not implied that change in the value of one variable causes changes in the value of another (Bordens & Abbott, 1991). When variables change together in this way they are said to covary. When one first develops explanations for observed phenomena, knowledge of observed relationships can serve as an important guide, even if one may not yet know which relationships are causal and which are correlational. Distinguishing between causal and correlational relationships is thus an important part of the research process, particularly in the hypothesis testing phase. However, one's ability to distinguish causal from correlational relationships may vary with the degree of control, or amount of information, one has over the variables in the study.

In historical research, one is examining the records of the past for one's data so, there is little or no opportunity to manipulate any variables. Therefore when approaching a problem, such as the success or failure of a particular natural resource management strategy, it is probably inappropriate to state the problem in terms of variable causal relationships such as, does the management strategy work? A more straightforward and useful statement of the problem such as, what were the events that led to the success or failure of particular fisheries management strategies, implies that a particular sequence of events led to the decline. Therefore, one can make a comparison between the sequences of causes or events that led to the decline or success of the fisheries in different regions. The timing of the events, rather than the events themselves, becomes the focus of the comparison and not the events themselves.

In a commingled methodology that integrates a causal comparative approach with a historical approach in a case study, the researcher must realize the danger of limiting the comparison to just the sequence or timing of events. Other variables, which are out of the

control of the researcher, such as the magnitude of each event, the synergistic or antagonistic effects of the events on each other, as well as cultural differences, may greatly affect the timing of events or be affected by the timing of events.

Ex post facto cause-effect comparative research is a variation of this commingled methodology in which one has an existing situation whose historical causes one wants to establish and compare to a similar situation. Since the variables cannot be manipulated, one can never be sure that a cause and effect relationship exists but the evidence can be used to imply a relationship to varying degrees of certainty. Some of the hurdles to be surmounted are that the researcher may fail to single out a really significant factor, fail to recognize that events often have multiple rather than single causes, base conclusions on a too-limited number of occurrences or fail to recognize that some factors may go together without having a cause-effect (causal) relationship (i.e., correlational) and may lead the researcher to false or misleading conclusions. It is incumbent upon the researcher to obtain a sufficient amount of reliable data to convince the reader that there is a high probability that a cause and effect relationship exists (Keppel, 1991).

By combining or commingling causal comparative methodology with a historical approach this study was able to explore why once decimated fisheries harvests in one region have reached sustainable levels while in other regions the harvests have not reached those levels and are, in fact, continuing to decline. In the process differences in the fisheries regulations and/or regulatory incentives, the allowable method of harvest, the regulated length of the harvest season, the incidence of disease, impact of pollution, degree of habitat destruction, or weather variations were discovered. With a research question or questions in mind, the records and past conditions of differing regions were searched for a cause-effect relationship(s) for each region and then they were compared. The assumption was that if a cause was present that an effect was generally observed.

In general, descriptive research may be used to define goals or objectives and the ways in which they might be reached. Causal comparative research, with or without a historical perspective, involves more than just fact gathering and tabulation. Specifically, this study dealt with the analysis and interpretation of the data which was gathered for the purpose of examining the different oyster fishery management strategies employed in the Chesapeake Bay and elsewhere, their efficacy, the causal factors that contribute to or inhibit their level of efficacy, and comparing them between private and public fisheries in the Chesapeake Bay, and elsewhere in the United States. It was hoped that this would result in a better understanding of the strategies employed and associated influences, and perhaps provide some direction toward a solution to the significant problems facing fisheries managers to build and sustain a viable fisheries in Maryland, and all of the Chesapeake Bay.

# CHAPTER 4

## Results

## Maryland Oyster Fishery Regulations

### Current Regulations

Limiting access. Current oyster fishery regulations, which include required licensing of watermen, as well as limitations on season duration and catch, reflect a limited-access management strategy particularly as it applies to use of the public oyster beds. With few exceptions, the regulations that apply to leasing of bottom for oyster farming have been unchanged for over 100 years. The Maryland oyster fishery is administered by the Department of Natural Resources (DNR) in cooperation with Tidewater county committees of licensed watermen representing each of the gear types (tonger, patent tonger, dredger, or diver) with five persons for each gear type. However, the Maryland legislature is still responsible for enacting the laws affecting the fishery.

The history of the public oyster fishery in the Chesapeake Bay has not always been one of plummeting harvests. In recent times, there have been occasional increases in the population but they have not been anything close to what the harvests once were. In an effort to stave off any rapid increase in the number of watermen harvesting oysters in times of oyster population rises, the DNR only accepts applications for new licenses from those who have been crew members for a licensed waterman for at least the prior 2 years (Maryland Department of Natural Resources, 1994-1995). Therefore, a rush of new watermen and subsequent increased harvesting is avoided in times of plenty by the mandatory 2- year delay. In addition, the DNR determines when the start of the oyster harvesting season is and how long the season will last. The length and starting date are subject to the DNR's assessment of the population abundance. However, here again, the start and length of the season are often points of dispute by the watermen, and the Legislature often intervenes in the watermen's favor, against the recommendations of the DNR.

There are also times and places where only certain types of gear may be used, per person catch limits (25 bushels/licensee/day if hand or patent tongs are used), and per boat catch limits (75 bushels total/boat regardless of the number of licensed tongers). It is required that all oysters harvested from natural bars be culled on the bar where they were caught. Any oyster less than 3 inches in length must be returned to the bar where it was caught.

In an effort to provide some incentive for leasing of oyster ground, the DNR annually designates certain areas of natural oyster bars as off limits to the public fishery for the planting of seed by the state. Only lessees of private oyster grounds may take seed from these areas to build up their own beds. However, there is a limit as to the amount of seed that can be harvested and there is a per bushel fee for the seed. Not long ago, Maryland oyster farmers obtained most of their seed from Virginia and Delaware Bay, which was more expensive. However, now there is a ban on the export of seed from Delaware Bay. Leasing of oyster grounds in Maryland by a corporation or joint stock company is still prohibited. With the exception of a few counties, the amount of barren ground that an individual may lease is 1-30 acres within county waters and 5-500 acres in Chesapeake Bay waters lying outside county waters. There is an application fee ($300) as well as an annual leasing fee. One serious barrier to leasing, beside the cost/risk, that is a holdover from times past, is that when a new application is made to lease, the lease may be challenged by any person who feels that granting of the lease may adversely affect them. This often results in denial of the lease application based on very flimsy evidence.

Taxation. Current legislation taxes each bushel of oysters harvested and sold in Maryland and each bushel sold out of state. Those taxes are collected by the DNR and are earmarked for the state's oyster repletion program (Leffler, 1988). The repletion program is the seeding of public beds. However, in spite of the demonstrated resilience of Eastern oyster

populations in the Bay, decades if not a century of overfishing and mismanagement, coupled with repeated failures in recruitment of young oysters, have led to historically low harvests. The harvest rate far exceeds the repletion rate, in spite of gear and season restrictions (Burling, 1991). Brood stock and cultch are removed from the public beds while insufficient attempts are made to establish adult reserves or to return shucked shell to the region from which it was taken (Kennedy, 1989). The leveling of reefs has resulted in a reduction of suitable oyster habitat.

In years past, buy boats would ply the waters and circulate amongst the watermen's boats, buying their catch right at its source. Buyers were middlemen afloat and would in turn sell their purchased supply of oysters to the restaurants and processors (Kennedy, 1989). Now the buyers stay dockside and the watermen go to them. Since it is the buyers that must pay the tax to the DNR for every bushel that they purchase, there is gross underreporting. This hurts the repletion program, and consequently the watermen, and it makes it difficult for the state to accurately gather reliable harvest data (personal communication, Connie Lewis, DNR, Annapolis, MD, July 7, 1996).

## The Property Rights Structure of the Chesapeake Bay Today

Leasing and limited access to the commons. Both Maryland and Virginia waters are plagued by disease, and one cannot consider the oyster fishery without considering the part that disease plays on its commercial viability. Some parts of the Bay occasionally still receive large natural settings of larvae, though these are very rare. When this happens, both Maryland and Virginia hire watermen to harvest shell with spat attached from these areas, and then transplant them to areas better suited for rapid oyster growth and/or areas less likely to have a heavy disease infestation. This state-funded movement of seed and shell is known as the repletion program. It should be noted here that in Maryland the same watermen who were paid by the state to move

seed can also turn around and harvest the market sized oysters off the same beds for a small tax and licensing fee and sell them for the highest price the market will bear. Also, in Virginia the seed harvesters may sell seed to private planters. Both states place shell (cultch) in seed-producing areas to enhance setting rates and seed production. In addition, planters have developed their own seed beds by placing shell on the barren grounds available for lease (Santopietro & Shabman, 1992a). However, most private growers must compete with state management programs for seed and shell.

The current property rights structure of the Chesapeake Bay's oyster grounds was fully developed by 1910 and by then the differences between the two states, in terms of private leasing and management of public grounds, were evident. Since then, oyster policy in both states has been primarily directed toward management strategies for the public grounds. In the evolution of these property rights structures, the watermen working the public grounds in Maryland have been more successful than their Virginia counterparts in their efforts to restrict private leasing and in obtaining support for public grounds management.

The distrust of the government by the Maryland watermen, regardless of the lack of validity for their fears, suggests that they were, and still are, concerned that privatization would redistribute their perceived natural rights to employment and income in the fishery to a wealthy class of planters. The prevailing attitude amongst the watermen was, and is, that an open-access type of fishery is an entitlement, if not a right defined by law. Historically, Maryland watermen were a poor class of European Americans and former slaves with no interest in becoming farmers, whether of the land or of the sea (Stevenson, 1892; Wharton, 1948, 1949). In both Maryland and Virginia, the watermen believed that wealthy, outside corporate interests would gain control of all grounds made available for lease if any leasing were permitted at all. In other words, a toe in the door by individuals might open wide the leasing grounds to corporations.

This unfounded paranoia exists even today. This differs greatly from the attitude of the Delaware Bay oyster fishers who, for the most part were, and are, both farmers of the land as well as oyster fishers, many with their own leases (personal communication, Dr. Susan Ford, Haskin Shellfish Laboratory, Port Norris, NJ, August 18, 1995).

The Maryland watermen have been successful in restricting leasing of Bay bottom for the private cultivation of oysters for a number of reasons:

1. The watermen were, and still are, considered an underclass and their possible displacement by expanding private leaseholds is considered to be detrimental to the local economies of the regions around the Bay. Therefore, maintenance of the public fishery by the government is seen as a means of keeping the watermen employed and off welfare. This point is somewhat ironic, for over the years, the amount of tax dollars that have gone into the public fishery far exceeds the return to the state (in the form of taxes and fees) (personal communication, Gary Smith, DNR, Oxford, MD, October 29, 1996). As Stevenson (1892) noted before the turn of the century, the economic stability of the tidewater counties depended on the wide distribution of the benefits provided by the preservation of the public grounds. Any change in policy adversely affecting the income-earning opportunities of the watermen, particularly the tongers, would have repercussions throughout the communities' economic structures. The question then becomes, are these economic structures appropriate?

2. In Maryland, the potential leaseholders were not, and still are not, a favored class. Since the cultivation of oysters requires an initial investment in grounds preparation and allows the use of capital-intensive harvest techniques such as dredging, there was, at least in the past, reason to expect that the leaseholds would be taken up by the processors (shuckers, packers, shippers) who had access to investment funds (Santopietro & Shabman, 1992b). Before 1900, the processors were for the most part the descendants of the New England dredgers and thus

were considered outsiders, especially in Maryland. Since New England was already moving toward oyster farming and was realizing the economic benefits, the Bay processors tended to favor privatization.

3. Legislative representatives of the tidewater counties were responsive to the voting numbers of the watermen, who opposed leasing. These legislators took a leadership role in the development of a property rights system that the watermen would accept (Alford, 1975). Today, the number of watermen on the Bay is greatly reduced, and yet legislative policy, particularly in Maryland, is still fashioned to meet the needs of so few at the expense of so many.

The forces opposed to, and in favor of, private leasing are not the same in Maryland as in Virginia. The pressures for granting private leasing in Virginia were stronger than in Maryland because the more saline waters of Virginia offered a higher rate of return for private cultivation. There were two reasons for this. One is that an oyster's growth is directly correlated with salinity; the growth rate is more rapid in saline waters than in less saline waters. The second reason is that Virginia oysters commanded a higher price because Northern consumers, accustomed to the taste of oysters taken from their own ocean coastal waters, preferred them to oysters taken from the less saline waters of Maryland. With greater potential gains, prospective leaseholders were more active in the legislative process in Virginia (Winslow, 1894). Oyster laws passed in Virginia in 1892 permitted significant private leasing of barren bottoms for cultivation. Grounds where oysters could grow naturally were reserved as public grounds. A survey of the Virginia grounds to identify the naturally producing bottoms was conducted by Lieutenant Baylor, USN, and hence, these grounds became known as the Baylor Grounds (Haven, Hargis, & Kendall, 1978).

Virginia watermen were less resistant to private leasing than were Maryland's watermen for several reasons:

1. One reason is that the expansion of private planting created a market for seed harvested by hand-tongers. This was because the most important source of seed was the James River in Virginia, where seed beds were reserved as public grounds (Shabman & Thunberg, 1988). Up to the 1990s the Virginia watermen jealously guarded their perceived entitlement to the James River seed. However, disease took a heavy toll on the seed beds in the 1960s and by the late 1980s oyster populations were barely at sustainable levels (Abrahms, 1992).

2. A second reason was that many Virginia planters were opposed to dredging on leaseholds because of the difficulty in keeping the dredge within one's property lines. They instead preferred to hire hand-tongers to harvest the oyster grounds, thereby creating employment opportunities.

3. A third reason is that many private planters had their grounds harvested by hand tong because if they dredged, the substrate in which they invested would become silted over and the integrity of the beds destroyed. Tonging minimized disturbance to the bottom.

As a result, tongers' opposition to leasing was muted in Virginia by the higher expected returns (than in Maryland) and by the employment opportunities created by private planters on both the private and the public grounds. Leasing grew rapidly in Virginia and by 1902 production from the private grounds exceeded the harvest from the public grounds (Stagg, 1985). It is important to note that this remained true until the 1970s, when the effects of disease were being felt on both the private and the public beds.

Maryland's watermen were strongly opposed to leasing of either natural or barren bottoms. However, with its lower salinity levels, expected returns from private planting were not as large. Though leasing of barren ground was eventually provided for in the Haman Act of 1906, this law also included many provisions that inhibited private cultivation (Case studies in management, 1991). Most of these restrictive provisions are still in place today, and the lack of

adequate enforcement exacerbates the situation. Perhaps the greatest disincentive to private planting was the clause that permitted legal challenges to the lease. It in effect made all leases applied for subject to challenge and dismissal, or refusal.

Many basic textbooks on natural resource economics now use the public oyster grounds of the Chesapeake Bay as a prime example of the economic inefficiency of all common property resources (Randall, 1981; Tietenberg, 1988). Frequently these economic studies purport to demonstrate that there is too much labor and too many boats in the fishery. The call for privatization of the beds is even older than these relatively recent economic studies and can be traced back into the last century (Brooks, 1891; Paxton, 1858). Nonetheless, the evolution of property rights to the Chesapeake oyster grounds has not resulted in the complete privatization of the grounds, which was both predicted and advocated by the NRE approach.

According to Santopietro and Shabman (1992b), establishing a private property rights structure for all oyster grounds in the Maryland oyster fishery would have had two effects on labor:

1. Capital, in the form of dredges and patent tongs, would be substituted for labor, needed for hand tonging, thus reducing employment opportunities in the fishery. The argument against this notion, however, is seen in the Virginia fishery where hand-tonging is the preferred method of harvest since it retains the integrity of the oyster beds and reduces damage. Therefore, it is incorrect to assume that privatization of Maryland beds will displace hand-tongers.

2. The character of the work experience of being a waterman would be altered from that of a risk-taking harvester of the natural oyster population, to that of a production manager or employee of an aquaculture enterprise.

Integrating corporate change strategies into fisheries management. Recent fisheries failures, combined with changing views on management, point to the critical and urgent need for a new approach to fisheries management. Serious consideration should be given to future management strategies focusing on integrated approaches in fisheries. Rather than focusing solely on fish populations, an appropriate combination of biological considerations with operational, social, and economic considerations of the fishery should be implemented. This requires development of both a conceptual framework and an appropriate methodology for interdisciplinary decision making in fisheries management. This would entail integration of the traditional fields of fishery science and corporate management with the social sciences. This could provide the framework and methodologies for defining multiple objectives and constraints, modeling alternative management scenarios, and assessing and managing risk (Stephenson & Lane, 1995).

The limitations of the current approaches to oyster fisheries management in Maryland are complex, but common characteristics with other failing fisheries include the following:

1. An inability of management strategies to deal with the inherent variability of the environmental, biological, and economic aspects of fisheries systems (Magnuson, 1991).

2. Failure to define long term management goals that meet specific biological, social, and economic objectives and targets for fisheries (Serchuk & Smolowitz, 1990).

3. A lack of year-to-year accountability in management decision making and an inability to react to and anticipate change (Lane, 1992).

4. Predominance of biological advice that does not adequately address economic, social, or operational considerations.

5. Lack of effective involvement by stakeholders and vested interest groups in fisheries management decision making (Pearse & Waters, 1992).

6. Pressure by government regulatory agencies (usually state) to rationalize cost cutting measures as a means of improving efficiency (Parsons, 1993).

Biological evaluation of stock status has been the cornerstone of fisheries management. The post-World War II era saw some change in philosophy, from the pursuit of *maximum sustainable yield* (MSY) to the pursuit of the more diffuse concepts of best use or *optimal yield* (OY) that were to incorporate biological, economic, and social objectives (Parsons, 1993). However, change has been slow and ineffective.

## Community-Run Alternatives

Working together. There is evidence to suggest that the tragedy of the commons is neither universal nor inevitable (Leal, 1996). In several parts of the world, local fishers manage communal fishing grounds, usually without much government interference, and they are successful in preventing overfishing. For the most part, these arrangements are community-based, spontaneously developed, and informally organized (Jentoft & Kristoffersen, 1989).

The very existence of these fisheries challenges the notion that all fishers are necessarily locked into a self-destructive pattern of competition that invariably leads to severe depletion of the resource. They serve to illustrate that a fishery can be self-regulated. Fisheries management attention has grown in recent years, providing valuable information on why such management can occur. Elinor Ostrom (1990) has identified the characteristics that have enabled groups of fishers to manage commons over long periods of time without bringing about a tragedy of over exploitation. She found that (a) boundaries must be well defined, (b) rules must be linked to local conditions, and (c) sanctions must be imposed when rules are violated. In addition, Ostrom found that strong community traditions are essential for such management, as well as an absence of interference by governments.

In Robert Pomeroy's (1991) study on small-scale fisheries management, he determined that to develop a more effective fisheries management program, it is necessary for decision makers to change their basic assumptions regarding the environment of small-scale fishers. Of particular concern are the mistaken assumptions of homogeneity of fishers and fishing communities, and the perceived irrationality of fishers' behavior.

The prevalent problems in fisheries include limited resources, lack of market power, lack of alternative income, and inflation (Pomeroy, 1991). To this list may be added inaccessibility to credit, inadequate infrastructure and support services, and lack of enforcement of regulations. Suppositional problems are those related to the assumptions held by fisheries managers concerning the behavior of fishers, the social and economic structure of the communities in which the fishers live and work, and the nature of the resource base.

In searching for solutions to the problems that contribute to the low economic standard of living among small-scale fishers, like the Chesapeake watermen, fisheries managers have too often given limited priority to the social and economic diversity which exists among fishers and fishing communities, and to the perspective of the fisher (Pomeroy, 1991). This results in conflicts arising between the objectives set by fisheries managers and the results obtained.

Many small-scale fishers exist at a subsistence level and have a short-run, survival strategy of taking care of themselves and their families each day. These fishers, due to limited mobility and lack of sufficient alternative employment to move completely out of the fishery, will utilize whatever resources are available to them (technology, skill, capital) to harvest as many fish as possible. For if they do not harvest as many fish as possible, the belief is that another fisher will. The fishers prefer profits and food now rather than a continual flow of fish and income later. In contrast to this short-run survival strategy of many fishers, fisheries managers are primarily interested in long-term sustainability of the resource to maintain a source

of food and income.

An alternative strategy that may address this is a community-based approach designed to be responsive to the diversity of factors which exist among fishers and fishing communities and the long-term survival of the community and the fishery (Pomeroy, 1991). While not a new approach, what is innovative about the community-based approach is that it would combine goals of fishery management and rural community life to find solutions to both specific problems faced by fishers, and the underlying causes of these problems.

As with terrestrial hunters, many fishers of coastal waters lay claim to a right of first access to harvest, which is coupled with rules that govern participation and use. Measures such as ensuring that access to prime fishing ground is equitably distributed among rightful participants, rules governing fishing conduct, and the application of specific sanctions against violators, have all been documented as forms of traditional local self-management in coastal fishing settings (McCay & Acheson, 1987). Four examples of community-run, cooperative fisheries, with differing degrees of government involvement, are presented below.

Matinicus Island, Maine. One example of a successful, community-run fishery can be found on Matinicus Island in Maine. The island's lobster fishery has operated successfully for over a century without official state recognition despite many changes, including expansion into regional markets and dramatic improvements in boat style, fishing technology, and navigational equipment (Bowles & Bowles, 1989). While the number of fishers has deviated little from the original number of 36, fishers did move in and out of the fishery. On well-protected waters like those off Matinicus Island, lobster fishers themselves have instituted conservation efforts, including limiting the number of lobster traps used. The annual income of the Matinicus Island fishers is 40% higher than the income of lobster fishers in the more open areas off the coast of

Maine, and the fishing is twice as productive as in more open areas (Acheson, 1993). The right of an islander to fish for lobster is recognized and respected by the other islanders. Self-imposed restrictions on lobstering have existed for over a century and sanctions for violating these rights and restrictions include property destruction, such as trap cutting. It is because this is such a tightly-knit community and that the penalties for violating the restrictions developed by the lobstermen themselves are severe that this system of fishery management works. The fear is, though, that the state could wipe out the entire territorial system if it chose to by enforcing state and federal laws against trap cutting. According to Acheson (1993), communal management exists only because of the benign neglect of the state. The key reason that this community-run fishery is so successful is because the rules and the enforcement of those rules are implemented by the fishers themselves. The fishers have a role and a stake in its success.

Gulf Coast shrimp fishery. For the most part, community management involves limiting entry and setting fishing rules. Another example of what once was a community-run fishery is the Gulf Coast shrimp fishery where, from the 1930s to the 1950s, shrimpers themselves negotiated price agreements with shrimp purchasers, as well as determining entry limits. Economists observed that shrimp fishermen unions and trade associations negotiated with local wholesalers to set minimum price floors and size limits for small shrimp taken from the Mississippi River. These higher prices reduced the quantity of small shrimp taken from the Mississippi, since wholesalers would only pay if the shrimp were big enough to justify the higher prices.

Unfortunately, the communal fisheries management scheme was dismantled by the federal government as a violation of the Sherman Act, which allows government intervention in the regulation of a food source. Ironically, the pricing strategy to conserve the fishery and raise

incomes is now being carried out by every Gulf Coast state in the form of state-instituted, minimum-size rules for harvesting shrimp. The informal arrangements that local fishers carried out to sustain their fisheries usually came about because government officials left local people free to design their own arrangements (Leal, 1996). Unfortunately, because these informal approaches have not always been recognized by the government and may in fact be defined as illegal, they are always at risk of being dismantled.

Lofoten fishery, Norway. It should be recognized, however, that in some cases government recognition and some minimal involvement can give validity and stability to the management scheme. Such is the case in Norway's Lofoten fishery. The Lofoten fishery is one of the largest cod fisheries in the world, in terms of numbers of fishers and the size of the harvest (Jentoft & Kristoffersen, 1989). There have never been government imposed harvest limits within the fishery nor a licensing system. For nearly a century, the fishers have successfully implemented their own fishing regulations, a responsibility officially delegated to them by the Norwegian government.

The impetus for community self-regulation came from overcrowding (too many fishers) and gear conflicts experienced in the fishery in the mid-late 1800s. Toward the end of the century, the Lofoten fishers decided that they needed regulation to overcome crowding and gear problems but they wanted to carry it out themselves (Jentoft & Kristoffersen, 1989). In 1897, the Norwegian government enacted the Lofoten law, which gave the fishers responsibility for regulating the fishery. The present system consists of 15 districts, each with separate well-defined territories. Each local district is responsible for developing and implementing regulations, enforcing the regulations, and resolving disputes among fishers. Both regulation and dispute resolution are carried out by each district's local regulatory committee, made up of

representatives from each gear group. These committees are not unlike those drawn from the Chesapeake watermen, with each oyster gear type represented.

The regulatory duties of the committee include dividing the district's territory into separate fishing grounds and reserving each for a particular gear type. To participate in the fishery, every fisher must register with one of the districts and follow the rules of that district for that season. The committee decides how big each territory for a given gear type will be (Leal, 1996). For example, seining, which represents the highest scale of harvesting power, has the least space available in the fishery. As a consequence, only about 15% of the total participants in the fishery use seine nets, thereby reducing the risk of overharvesting.

Newfoundland lobster fishery, Canada. The community-based, cooperative management strategy used in the Newfoundland lobster fishery provides an instructional example of how an understanding of indigenous values and practices can reveal the true motivation behind acceptance and enforcement of measures that conserve the lobster stocks. Erroneous assumptions about fishers and fishing communities can lead to conflicts in attempts between fishers and fisheries managers to co-manage and conserve the fishery.

Though the lobster fishery along the northwest coast of Newfoundland is governed by many of the usual institutional formal regulations (e.g., season limits, limited entry licensing, territorial divisions, and trap limits), it is generally considered to be successfully, cooperatively managed by both the lobster fishers and regulatory officials. In this example, it is useful to examine the relationship between indigenous practices and formal regulations in the Newfoundland fishery so that it might shed light on potential relationships between fisheries managers and fishers in other regions, such as the Chesapeake Bay. As Craig Palmer (1993) discovered, the success of the formal regulations in Newfoundland has little to do with their

similarity or even compatibility with the fishers' self-imposed regulations. The acceptance of formal regulations, intended to conserve the fishery, appears to be largely based on the fishers' realization of the non-conserving nature of their indigenous practices, as well as a desire to retain social norms. The absence of conservation-minded, indigenous practices may be the result of the relatively short history of the Newfoundland lobster fishery, and/or the exploitive market conditions under which it has operated.

Palmer (1993) argues that many current conceptions of indigenous practices are based on a flawed theoretical approach, sometimes referred to as the notion of the noble savage or soft evolutionism. He suggests that it is time to revise the current assumptions about the nature of indigenous management practices in order to understand their potential role in the formation of cooperatively managed fishery policies. Palmer goes on to argue that instead of using indigenous practices simply as models for formal regulations, attention should focus on the motivation of fishers engaging in indigenous practices and the socioeconomic context in which this occurs.

The lobster fishery along the northwest coast of Newfoundland is currently regulated under many of the restrictions that are common to entirely government regulated fisheries. However, in the Newfoundland lobster fishery these regulations have been relatively successful socially, as well as biologically, because most of them are supported by participants in the fishery. The biological and social success of these formal regulations does not result from their being modeled on indigenous practices, as one might expect (Palmer, 1993).

The lobster fishery along the northwest coast of Newfoundland originated in 1873 with the establishment of the first lobster cannery. Harvesting and canning lobsters remained an important activity until the 1930s when canning was gradually replaced by the shipment of live lobsters to Boston (Sinclair, 1985). Before the 1960s, the enforcement of government imposed regulations along this coast was even more limited, if not nonexistent, than in the rest of Atlantic

Canada. Local fishers who participated in the fishery before the current regulations were implemented made it clear to fisheries managers that there was little in the way of indigenous restraint. There were, for example, no locally imposed restrictions on the number of participants in the fishery and fishers felt that it was their natural right to catch lobsters (Palmer, 1993). This has a familiar ring as one compares the attitudes of Chesapeake watermen with Newfoundland fishers. A crucial point to be emphasized is that the indigenous management practices did not prevent a severe depletion of the lobster population, and the fishery was at the point of collapse from overexploitation. The realization by the fishers themselves of the vulnerability of the lobster stocks was a major motivation for supporting and participating in establishing co-managed (government and lobster fishers) formal regulations.

The social acceptance by the Newfoundland fishers of formal regulations, with all it entailed for reduced enforcement costs and the conservation of the resource, depended on the conscious concerns and values of the fishers. The value of the indigenous practices lay in what they revealed about these concerns and values. The indigenous practices in northwest Newfoundland serve to illustrate why the conscious motivations for a practice are more relevant to fisheries managers than are the unintended effects of the practice. For example, nearly all northwest Newfoundland lobster fishers observe a ban on Sunday fishing, a ban that was once part of the government imposed regulations. When a few fishers convinced the Department of Fisheries and Oceans to allow Sunday fishing, the majority of fishers banded together and used informal means (coercion, community pressure) to keep the ban uniformly observed. Abstaining from fishing on Sundays certainly does have some conservation effect on the stocks, but that is not why the ban continues to be unofficially observed (Palmer, 1993). Most fishers do not want to fish on Sundays for religious or social reasons, and they do not want anyone else to fish on Sundays because they fear those who do will take advantage of the opportunity to steal lobsters

from other fishers' traps. From a regulatory perspective, the importance of this indigenous practice lies in what it implies about the conscious values and concerns of fishers. Instead of reflecting an interest in conserving the resource for the long-term good of the group, the local adherence to this practice revealed that the fishers were concerned about retaining their social/religious norms and maintaining their personal catch levels by preventing poaching. Hence, it cannot be assumed that these fishers would support new formal regulations aimed at conserving the resource if they resulted in decreased personal catch levels, even if these regulations superficially resembled established indigenous practices.

Here is an example of a relatively young fishery (as fisheries go) where completely handing the management of the fishery over to the local fishers, as was done on Matinicus Island, would have resulted in the fishery's collapse. Yet, imposition of government regulations without working with the fishers and understanding the motivations behind local practices would just as easily have resulted in failure.

The cooperative management of the Newfoundland lobster fishery suggests that a focus on the conscious goals and motivations involved in indigenous practices contributes much more to the conservation of the resource than the prevailing sociological approach to indigenous practices based on the notion of the noble savage (Palmer, 1993).

## Nonmonetary Benefits

### Quality of Life

According to surveys of mid-Atlantic region fishers conducted by Gatewood and McCay (1990), coastal (including bay and estuary) fishers derive relatively little satisfaction from competition (catch numbers) and prestige issues. After the chance to be working outdoors, it is the opportunity to be one's own boss, being out on the water, having the ability to come and go

as one pleases, the healthfulness, and the peace of mind, that top the fishers' list of nonmonetary rewards. These reflect the strongly independent nature of coastal fishing as key components of satisfaction. Interestingly, the surveys also noted that deep sea fishers, unlike coastal fishers, derive their satisfaction out of the competition and the perceived prestige of deep sea fishing.

Gatewood and McCay (1990) argue that a logical connection can be made between fishers' job satisfaction and fisheries management in the following manner:

1. The strategy that preserves what fishers like about their work as much as possible and takes into account the full range of occupational rewards (monetary and nonmonetary) has the best chance of success because (a) its adoption may cause less resentment among the fishers, which in turn means that they may be less likely to try to circumvent the regulations, and (b) employing such criteria in formulating regulatory policies is more congruent with the central charge of fisheries management, which is management for optimal sustainability and human benefit.

2. If the components of job satisfaction in a given fishery are known, this information can be used to select more appropriate regulatory policies.

What Gatewood and McCay elude to but do not state explicitly, as Barber and Taylor (1990) did, is that regulatory policies are more likely to have fishers' buy-in and commitment if the components of job satisfaction are factored into the decision making. In so doing, the regulatory policies gain legitimacy.

Job satisfaction is truly multidimensional, and fishers are not a homogenous group. So too, in the applied context of formulating regulatory policies, Gatewood and McCay (1990) suggest, fisheries managers should consider not only how to achieve their conservation and economic goals, but also the specific nonmonetary rewards of fishing as these vary among different fisheries and regions. Because the total configuration of incentives and rewards is

fishery- and region-specific, it is both naive and misguided to think that there is a single, best way to regulate fishing effort, for there is no regulatory strategy that applies equally well to all marine (or fresh water) fisheries in all regions.

The NRE approach does not explain the evolution or the retention of the oyster fishery property rights structure of the Chesapeake Bay because the argument only considers the financial returns of substituting capital for labor (Santopietro, 1986). Economists studying the fishery have not, for the most part, included either the nonmonetary benefits that the watermen derive from the work itself nor the quality of life afforded by preserving opportunities to reside in the traditional fishing communities as the opportunity costs of adopting what they, as outsiders, would define as the more efficient system of private property rights.

Even if alternative employment were available outside the fishery or as hired labor for private planters, the watermen would realize a loss of self-satisfaction and pride by being denied the lifestyle of working on the water and being one's own boss. Owning one's own boat and gear gives the waterman a sense of independence not available in the alternative employments. Evidence of the existence of these nonmonetary benefits can be inferred by the opposition of the watermen to privatization. For example, in a survey of Virginia's watermen in 1985, 83% of the respondents said that nonmonetary benefits are important to them and 58% said that they knew they could earn more money working at another job (Santopietro, 1986).

The survey also found that 88% of the watermen had lived in their present communities for 20 years or more. Most of the watermen live in homes in communities bordering the water, so that they are near the grounds they harvest, or have harvested, and are able to return home each evening. An update to this particular point is that since the repletion program selects only particular areas to seed each year, some watermen are now traveling away from their homes to other parts of the Bay to where the oysters are available and may sometimes be away from home

for several days (personal communication, Gary Smith, DNR, Oxford, MD, October 29, 1996). These fishing communities are characterized by tightly knit family relationships (Bundy & Williams, 1978) with little migration into the community from the outside. If anything, the opposite is true. Young people are leaving the fishing communities looking for better opportunities. The lack of sufficient alternative employment opportunities in the fishing communities means that denying access to the public grounds is tantamount to denying individuals the right to continue to live in their own communities. The preservation of the communities has historically depended on the distribution of income afforded by a common property rights system (Santopietro & Shabman, 1992b).

The history of the Maryland oyster fishery, and the persistence of the property rights system, demonstrate that watermen prefer to work according to the rules and regulations necessary for the management of the commons. With this arrangement, all benefits from the oyster fishery flow to a variable input, the waterman's own labor. The limitations on harvest gear, the traditional use of small craft, and the greater abundance of oysters in shallow coastal waters have served to maintain these communities (Santopietro & Shabman, 1992b). A change in the property rights structure of the Bay's oyster fishery could involve a change in the distribution of income that could threaten the existence of the Bay communities. Only with this broader perspective of nonmonetary benefits and their link to property rights systems is it possible to understand the history of the fishery and avoid making inappropriate and ineffective policy recommendations for the future.

Job Satisfaction

Research by Pollnac and Poggie (1988) with New England fishers has shown that job satisfaction is an important pivotal factor related both directly and indirectly to a wide variety of

other social and economic variables. The relationships are positive, with high job satisfaction correlated with positive social and economic impacts, and low satisfaction with negative impacts. These relationships justify focusing on job satisfaction, and its social and occupational correlates among fishers as a means of providing fisheries managers with the understanding needed to make policy recommendations in the context of fisheries management decision making. Because job satisfaction is such a pivotal variable, fisheries management strategies that result in its maximization will help ensure positive social consequences.

Pollnac and Poggie's (1988) study demonstrates that there is more to the occupation of fishing than simply making money. Fisheries managers must take these other, nonmonetary factors into account if they want to develop effective management strategies. Nonmonetary incomes (worker satisfaction bonus) can push exploitation of a fishery beyond maximum economic yield, hence increasing the chances for over exploitation (Anderson, 1980; Smith, 1981).

Also, if alternative employment producing equal or better levels of job satisfaction is not available, exploitation of the fishery is pushed even harder. The complexity of the interrelationships between numerous variables suggests that considerable caution should be taken in formulating fisheries management strategies if the goal of minimizing the negative social impact of the management strategies is to be realized.

Accordingly, the introduction of culture into resource management complicates the nature of management. Cultural differences, particularly as they pertain to the most basic resource management tools and concepts, must be considered because resource management is a function of social and political institutions, not just biological considerations. Just as human impacts on ecosystems affect other aspects of the social system, very real social inputs affect natural systems (Tuan, 1990).

For example, the mid-Atlantic region of the Eastern seaboard (from New Jersey to Virginia) is like many others in that potentially helpful social science findings have not been seriously incorporated into fisheries management decisions or even into accompanying strategies. There are many reasons for this omission, including the resilience and resistance of traditional disciplinary biases. The culture of fishing is an occupational culture. In addition to the general humanistic reasons for fishers wanting to fish, it is important to consider that job satisfaction is particularly important in fisheries management. Unless fishers' satisfaction bonus is taken into account, management strategies will fall seriously short of their goals (Gatewood & McCay, 1990). Regulatory policies that presume fishers are only in it for the money are prone to underestimate the perseverance of fishing effort, the possible consequence being over-fishing of the resource.

By including job satisfaction in fisheries management objectives, it is recognized that what is economically optimal may not provide the maximal human benefits, because the rewards of work take two forms; monetary and nonmonetary. When economic models and biological models of stock replenishment and species sustainability are integrated (Gatewood & McCay, 1990), they show that unless fishing effort is regulated in some way, the common property nature of marine fisheries will lead to overfishing, stock depletion, and profit loss. Without limitations, the fishing fleet's collective effort will increase to the equilibrium point where revenue equals costs. The point of maximum economic yield (MEY) is determined by the level of fishing effort at which the greatest profit is realized, and this effort is well below the biological point of maximum sustainable yield (MSY), according to Schaefer's (1954) biological model. Economists argue that profit maximization is the proper management target and that fisheries must be regulated to achieve this goal, whether through catch quotas, gear restrictions, and/or limited entry licences.

The Oyster Population Decline Continues

Maryland is the only major oyster producing state in the United States in which private leasing plays such a minor role in production. The Maryland Legislature has provided few if any incentives to potential leaseholders to make such a large economic and time investment into aquaculture. In addition, there is no established means in Maryland for financing, or providing financial assistance for such potentially risky operations, especially with the hovering specter of oyster diseases. Corporations might have the financial stability to undertake oyster farming, as they have done in New England and on the West and Gulf Coasts, but century-old restrictions prevent the DNR from leasing grounds to businesses, and limit the number of acres each individual can lease. Most watermen adamantly oppose large-scale leasing of oyster grounds, arguing that oyster farming would limit their freedom and permanently alter a way of life that has shaped the distinctiveness of Maryland's tidewater communities.

Supporters of oyster farming in the Bay argue, however, that it will complement, not replace, the natural fishery. With potentially more oysters in the Bay from all sources, there will be more brood stock for spawning greater numbers of young. This could contribute to stabilizing the economic prospects of the watermen and the associated industries, such as the processors (shuckers, packers, shippers).

Recent pessimistic reviews of global marine resources (Food & Agricultural Organization, 1994), in combination with a diagnosis of global overcapitalization of fishing fleets (Food & Agriculture Organization, 1993), provide a major impetus for the current wave of concern on the state of marine resources and their management. Most people agree that there is a need to expand the fisheries management paradigm but do not agree on how. One thing that is commonly agreed upon is that there is a shortage of socioeconomic analysis and its application to resource management, particularly fisheries management. Fisheries management strategies need

to cross disciplinary divides and embrace the broader holistic perspective (Caddy, 1995).

Adapting recent concepts of management science and organizational theory to cope with environmental problems and declining harvests is a challenging approach that reaches out for alternatives to the current fisheries management strategies. In *Managing Sustainable Development* (1993), Michael Carley and Ian Christie argue that the context of natural resource management problems is turbulence, characterized by uncertainty about the nature of complex problems and the consequences of collective action, inconsistent and ill-defined preferences and values, and complex networks of participants, or stakeholders with varying interests in problem resolution.

It is clear from the following graphs that the past and present oyster fisheries management strategies, including the repletion program, have failed to prevent the continuing decline in the oyster population. Though some would argue that disease and pollution are the causes for the continuing decline, and cannot be ignored as contributing factors, the decline clearly started before disease struck (beginning in the 1960s) or pollution played a significant role in the decline (Figure 3). Overharvesting, including gear type and habitat destruction, is the primary cause for the continued decline in the oyster population. Pollution, and particularly diseases, are major contributing factors to the population decline and serve to exacerbate the natural recovery process of the Eastern oyster populations. The regulations that govern the harvesting of oysters, on private or public grounds, have changed little since their inception, despite overwhelming data demonstrating their failure. To their credit, fisheries managers within the Maryland DNR have made numerous recommendations to the legislature to change the regulations and have been, for the most part, ignored. It has been suggested that the state-funded repletion program is little more than a fishery subsidy, and that as long as the state is willing to

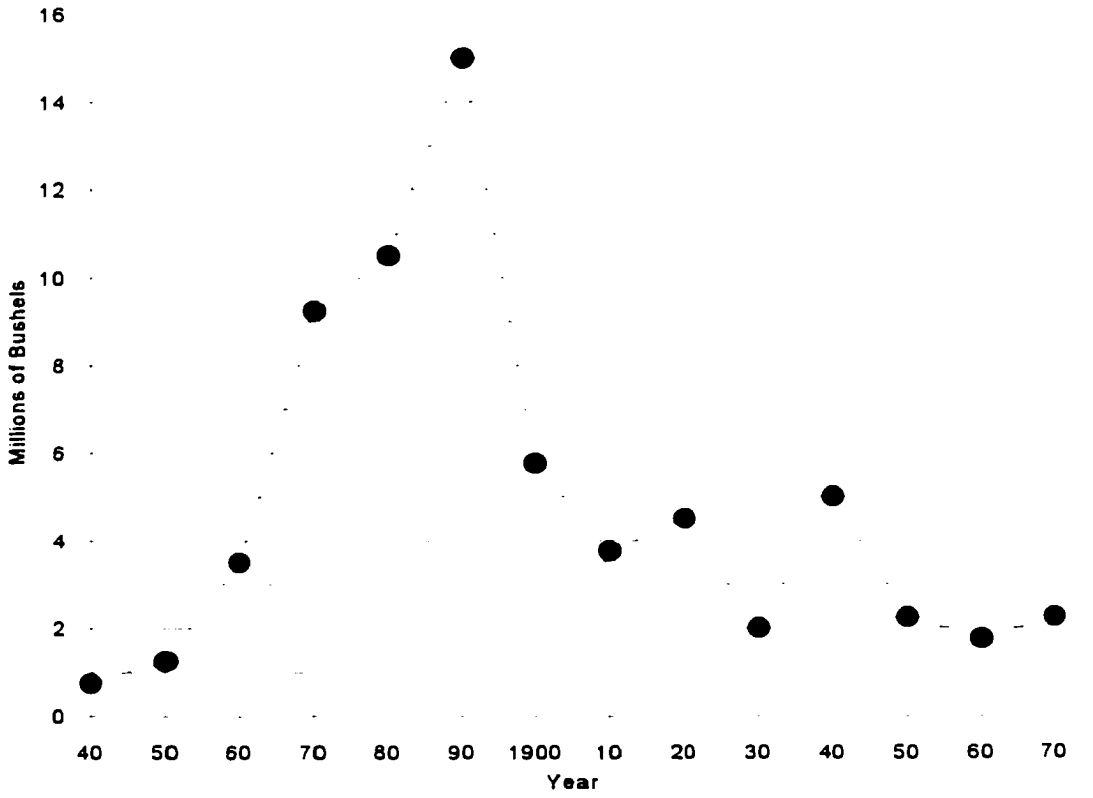


Figure 3. Total harvest 1840-1970. Maryland oyster fishery. Graph based on data in V. S. Kennedy & L. L. Breisch, 1983, Journal of Environmental Management, 16, 153-171; M. Leffler, 1987a, Maryland Sea Grant, 8(2), 2-6.

pour money into it, then the watermen will continue to lobby against privatization, and for continued access to the public beds until the last oyster is gone.

Though the total harvest in 1996 (200,000 bushels) was up slightly from 1995 (personal communication, Connie Lewis, DNR, Annapolis MD, December 10, 1996), and the gear types restricted and season cut back substantially, many watermen did not go out on the water on many of the allowed harvest days and did not even catch their harvest limit (Meyer, 1996b). Only in some of the tidal tributaries, where watermen operate tongs by hand from small boats, and where skipjacks and hydraulic patent-tongs are barred, were oysters said to be in any decent supply in 1996. The rising cost of operating a boat and paying a crew, along with the poor harvest, do not make it worth the effort to go out on the water often.

The dwindling fleet of skipjacks, which are the last commercial sailing fleet in North America, sit idle many days even when they are the only boats allowed to dredge. As a reminder, dredging is permitted on the Bay only under sail or on power days. Though some allowances have been made in that a motorized push boat may push the skipjacks two days a week during dredging season, giving them more maneuverability, the fishery is in such bad shape that opening day of dredging season in 1996 found no skipjacks on the Bay at all. Skipjacks cost approximately $10,000 a year to maintain and require crews of four to six experienced people to operate (Meyer, 1996b). The daily catch is limited to 150 bushels per skipjack, but during the 1997 season, 9 in 10 oysters dredged from the water were dead (Clark, 1997). It is more efficient, and thus more profitable for the skipjacks to operate on the two legal power days, Monday and Tuesday, when the small push boats with outboard motors can nudge the large skipjacks as they dredge for oysters.

Small pockets of naturally occurring disease resistant oyster populations have been found on rare occasion in the Bay, oysters that have clearly survived past the most susceptible stage. However, despite recommendations by fishery scientists to ban harvesting in these areas, harvesting has been allowed (personal communication, Gary Smith, DNR, Oxford, MD, October 29, 1996). Thus, dashing any hopes that these disease resistant oysters might spawn to produce disease resistant progeny. Ironically, at great expense to the tax payers, state laboratories are in the process of trying to develop genetically engineered, disease resistant oysters. Even if they are successful, it is unlikely that the tax/licensing fees, collected by the state for these disease resistant oysters will ever equal their true worth. In addition, as with mammalian diseases, what guarantee is there that MSX or Dermo will not mutate to more virulent forms?

There have been reports in the past, in Maryland and Virginia, that the harvest yield per acre of oyster ground was greater on private grounds than on public grounds (Kennedy &

Breisch, 1983). This added support to the notion that better care was taken of the private grounds, with less habitat destruction, because the lessee had a higher personal stake in the outcome. This argument is also used to promote the push for privatization to (a) protect oyster habitat, and (b) increase yield.

Further backing is added to this notion when one views the harvest yields between the public and private oyster beds in Virginia (Figure 4). Up until the late 1960s, when MSX struck Virginia's oyster beds in the more saline waters of the Bay (Andrews, 1968), leased bottoms were producing nearly five times as many oysters as the public bottoms and on fewer acres (Haven & Whitcomb, 1986).

difficult to demonstrate one way or another (Personal communication, Gary Smith, DNR, Oxford, MD, October 29, 1996). For starters, leasing of private grounds may only occur on barren grounds that are not known to have ever had any natural set. Therefore, from the onset, oyster seed must come from somewhere else and that somewhere has, for many years, been the public oyster grounds. In prior years, Marylanders could purchase seed from Virginia and Delaware Bay. However, declining seed availability from Virginia and Delaware Bay, and rising costs have resulted in the Maryland oyster farmers relying on state seeded beds for their supply of seed.

For over 100 years, greater than 75% of the seed planted on Virginia's leased beds came from the public bottoms of the James River (Haven, Hargis & Kendall, 1981). MSX was the cause of the initial major decline in production from Virginia's leased bottoms since many large leases were in high salinity areas, where oysters grow fastest but where unfortunately, conditions are more conducive to increased disease incidence. Since the 1960s, the steady decline in Virginia's oyster population has been attributed to continued overharvesting of the public grounds, the persistence of MSX, reduced planting efforts by private growers due to adverse

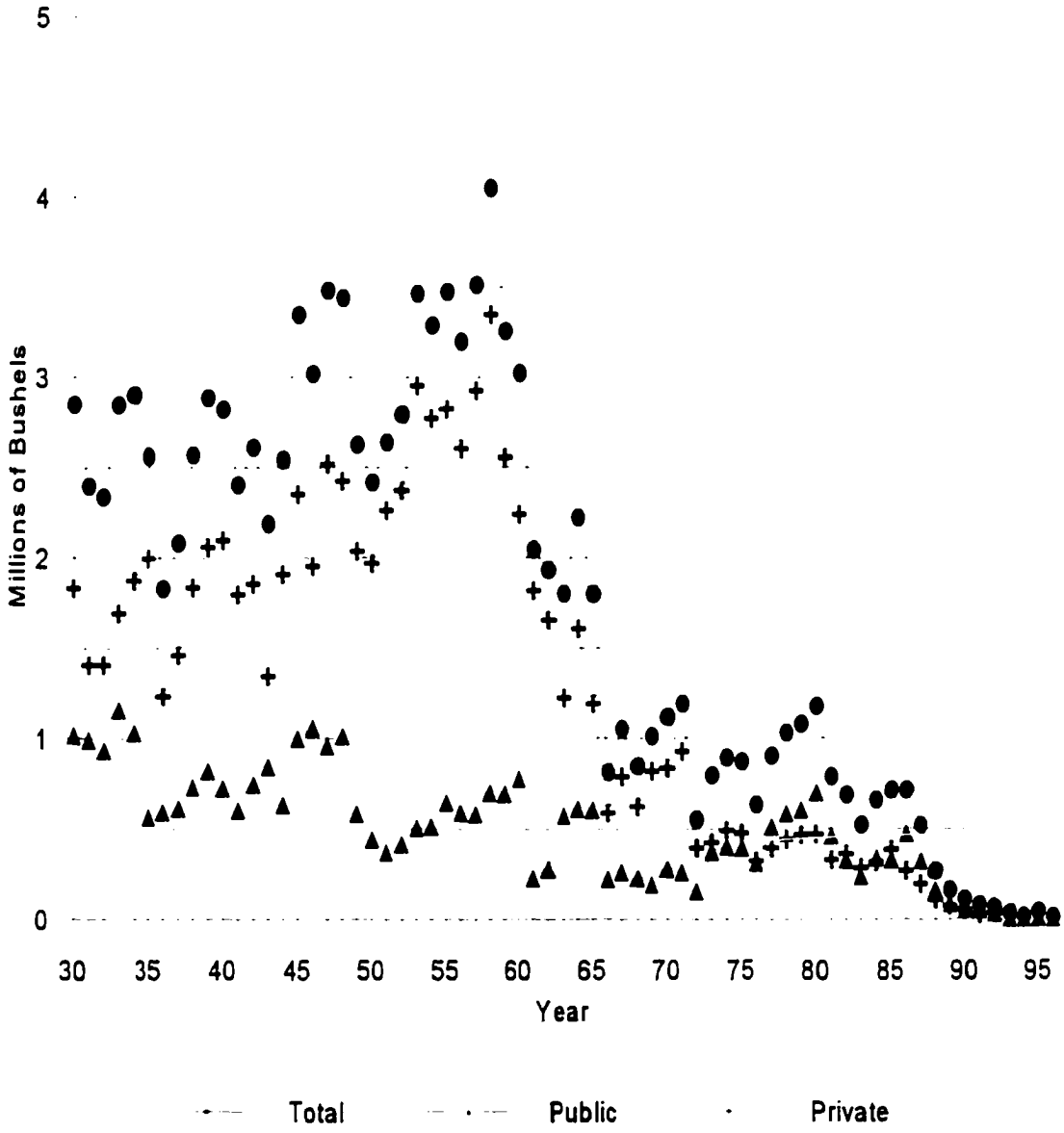


Figure 4. Annual harvest. Virginia oyster fishery. Graph based on data obtained from W. J. Hargis & D. S. Haven, 1988, Journal of Shellfish Research, 7(2), 271-279; Personal communication, David Bower, Virginia Resource and Marine Commission, September 1996.

economic conditions related to the costs of growing and harvesting oysters, and resistance to remedial improvements by industry and state managers (Hargis & Haven, 1988).

Thus, the oyster farmers in both Virginia and Maryland are highly dependent on the public bottoms for seed for their initial, and often continued, production. Therefore,

comparisons of yield/acre between the private and public grounds are misleading, and cannot be validated as a true comparison of yield nor provide support for, or against, privatization. It should also be noted that one of the reasons for the large difference in production between public and private beds in Virginia is that leased bottoms were usually planted with seed oysters from the James River at rates ranging from 500 to 1,000 bushels of seed per acre. In contrast, harvests from the public bottoms originated from a natural set, or from limited (compared to Maryland) repletion efforts by the state. Another point must also be made and that is that corporate ownership of leased oyster bottoms was, and is, permitted in Virginia, which assumes some higher level of capital available than to individuals to purchase seed. In addition, it is difficult to gather data that are oyster bed/acreage specific since the watermen are no longer restricted to their own county to harvest from its waters, or to sell their catch within their county. Records, therefore, are difficult if not impossible to keep (personal communication, Connie Lewis, DNR, Annapolis, MD, July 26, 1996). Since the harvest numbers are based on the taxes per bushel that the buyer pays, the numbers do not necessarily represent the harvest from a specific area.

To make matters worse, Maryland's natural beds have been subjected to heavy siltation, which makes it difficult for state surveyors to obtain accurate acreage data. Even annual harvest data comparing Maryland's private fishery with the public one (Figure 5) do not help one make a true comparison since the amount of leased acreage is so low, and by law, these beds need only be worked (seeded and harvested from) once every 3 years to be allowed to keep the lease (personal communication, Chris Judy, DNR, Oxford, MD, August 9, 1996; Maryland Department of Natural Resources, 1994-1995).

Therefore, rather than trying to make futile attempts to explore yield/acre differences between the private and public fishery to try to lend support to privatization in Maryland, information/data were gathered to provide a more comprehensive understanding of how the

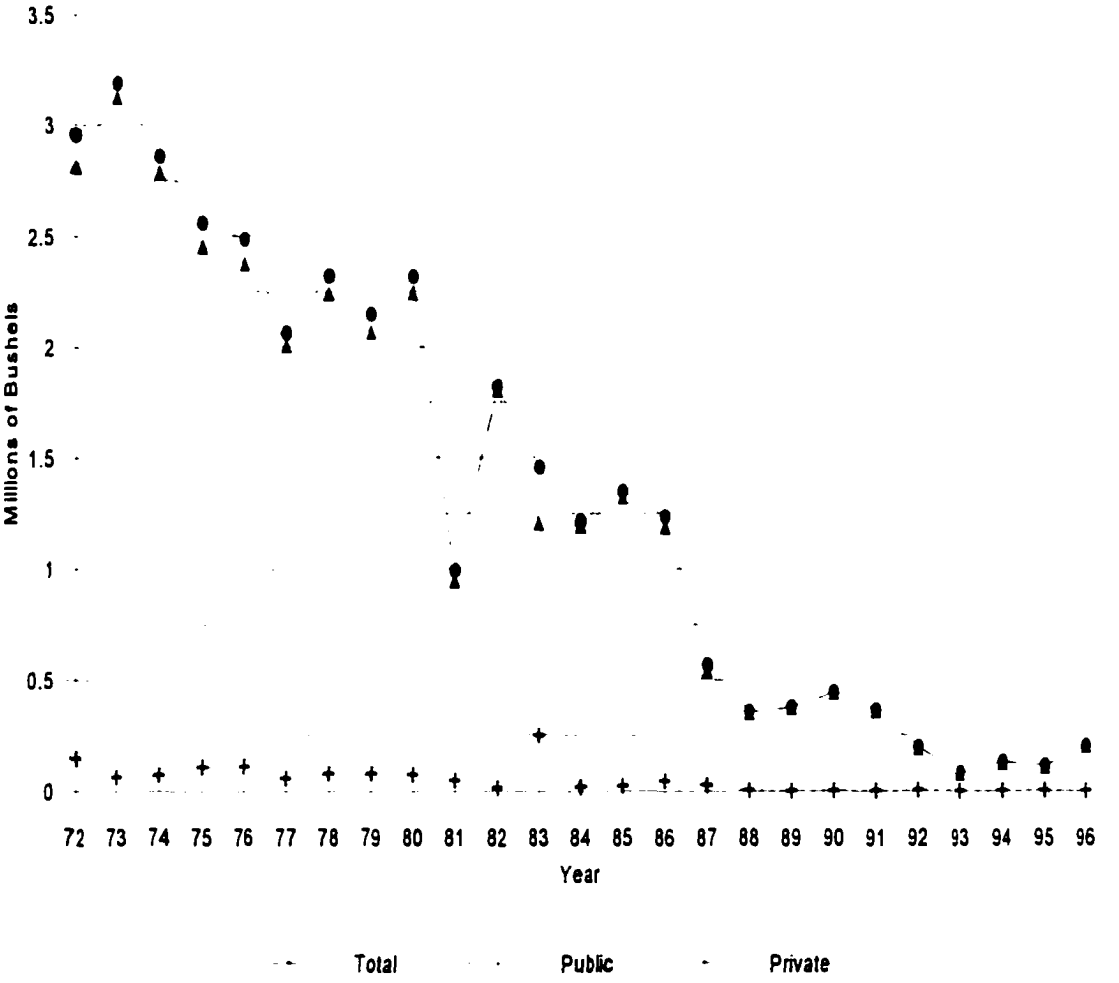


Figure 5. Harvest 1972-1996. Maryland oyster fishery. Data obtained from the Maryland Department of Natural Resources.

oyster fishery evolved to its current state, what socioeconomic and political factors influence it, how it compares to other oyster fisheries in the United States, and what alternative management strategies might be feasible. Clearly, as Figures 3, 4, and 5 show, change is needed now.

The Chesapeake Bay has long been known as one of the world's most favorable environments for the growth of oysters (DeBroca, 1876; Smith, 1913). The mix of fresh and salt waters, the circulation patterns, relatively temperate climate, and shallowness of the Bay create conditions under which oysters have flourished in the past. For more than 100 years the Bay was

the primary supplier of the nation's oysters. However, by 1976 the Bay had already fallen to second place in market share to the Gulf states (National Fisheries Statistics Program, 1984), then fell behind the West Coast fishery in 1987 (Abrahms, 1992), and now the total Bay harvest is less than 1% of what it was just after the Civil War (Brumbaugh, 1997).

Traditional bureaucratic, institutional forms and management approaches can no longer address natural resource management challenges adequately nor devise solutions that fit the complex problems (Hviding, 1991). Some important issues relating to people's role in fisheries management and to the common property debate need to be considered. Hviding and Baines (1994) argue that fisheries management must be viewed as linked to a number of contexts that are not specifically fisheries-related, with regard to the traditional perceptions and politics of resource use, as well as to modern development issues. In Maryland, the prevailing mood of many fisheries managers is one of frustration. They are charged with the responsibility of increasing the oyster stocks, but their budgets are slashed and their recommendations ignored by the legislators who determine the regulations and set the policies.

In the face of overwhelming data, scientific recommendations, and just plain common sense, the Maryland legislature and the watermen themselves have continued along a path that appears to be headed for the complete collapse of the oyster fishery. Why has this happened? Why is change so difficult? Is privatization of the fishery really the answer? What other alternatives are there? What follows is a synthesis and analysis of the information/data that have been collected to answer the many questions that have arisen, and to provide some understanding and guidance for future changes in the Maryland oyster fishery.

# CHAPTER 5

## Summary, Conclusions, and Recommendations

### Summary

The Maryland oyster fishery, a dual fishery, has struggled with the question of complete or increased privatization for over a century. Oyster fisheries in other parts of the country have embraced privatization, and successfully so. Yet, in Maryland there is still resistance. Though economics play a role in hindering the acceptance of increasing the role of privatization in the fishery, sociopolitical influences and nonmonetary benefits drive the legislative decisions that govern the fishery. The Maryland oyster fishery has a long history and carries with it a value system that is deeply rooted in the local traditions and a way of life that has come to represent the Chesapeake Bay. The culture of the tidewater communities and the Bay's unique ecosystem raise doubts as to whether the successful management strategies of other oyster fisheries can be beneficial to Maryland's oyster fishery, or whether community-based, common fishery alternatives are more suitable.

The Maryland oyster fishery, once the pride and economic mainstay of the Chesapeake Bay, has been irreversibly changed. Writers weave stories about the Bay of the past that depict quaint fishing villages and hard-working watermen dredging from their skipjacks under full sail or tonging from their workboats, with bushels of oysters stacked on their decks. As pretty a picture as these stories paint, that picture is a memory now. Most of the surviving skipjacks spend the majority of their time ferrying around tourists who are caught up in the nostalgia of the way things were. It is also more likely that one will find sport fishing charters on the watermen's workboats than bushels of oysters. In fact, the oyster population has declined so dramatically since the 1880s that the watermen, after taking all the oysters they can find off the public oyster grounds, still do not reach the quotas currently set by the state. Consequently, the watermen must find alternative uses for their boats just to make ends meet. In many of the oystering

families around the Bay, generation after generation has worked the oyster grounds. Now, the young family members seek alternative employment and often leave the small tightly-knit, coastal communities, resulting in a disruption of the community structure.

One must also take into account how the demographics of the Bay have changed over the years and how that may influence decisions in the Legislature in the future. Where once the Bay was surrounded by small, rural fishing and agricultural communities, it is now surrounded by suburban sprawl and industry, with all its associated blight and pollution. With that has come a decline in the economic importance of farming and fishing. The regional economy no longer relies primarily on commercial fishing or farming (Greer & Leffler, 1996). An agrarian and fishing society is increasingly being replaced by a society that depends on service-oriented, professional, and technical jobs (Johnson, 1988). As a result, a far smaller proportion of the population feels any economic connection with the Bay's ecological features and systems. And yet, even though the vast majority of the human population may naively ignore the plight of the oysters, oysters are the biological indicators, the canaries in the mine as it were, of the health of the Bay, and their presence or absence has broad implications.

Sociopolitical pressures against privatization have been a continuing saga since before the enactment of the Haman Act over 80 years ago. Fisheries managers need to accept that privatization is a management strategy that will likely never take hold in Maryland. Furthermore, the state administered repletion program is little more than a disguised welfare program that moves declining oyster populations from one commons area to another, to be completely fished out, and has done nothing to increase oyster populations.

Over a century of a tradition of fishing the public grounds, the commons, and the entrenchment of a value system and community structure that revolves around fishing the commons have provided significant impediments to the introduction of major legislative changes

and the resultant life-style changes needed to expand or completely switch over to a predominantly private property rights structure. The necessary legislative and attitude changes needed to convert the Maryland oyster fishery to a private property rights structure of fishery management would likely, if ever, take far too long to rescue the rapidly declining fishery. In addition, until there is a sizable disease resistant and/or disease free oyster population available as brood stock, there will be little chance of any significant investment, corporate or otherwise, in the fishery. Therefore, private cultivation of oysters is a management strategy that will likely not gain significant acceptance in Maryland among watermen and legislators. It is important to interject here that some important work is being done in the area of cultivation research. Many programs using the Eastern oyster, such as the one being conducted by VIMS, in which oysters are grown above the sediment laden bottoms, hold opportunities for both a private and a public fishery, but are not yet commercially viable. Change is needed now, and within a new management strategy, that is flexible and ever evolving, changes can ensue as other viable alternatives present themselves.

Nonmonetary, intangible benefits provide strong incentives for watermen to continue to fish the commons. This alone seems to supersede most economic arguments to privatize or leave the fishery entirely. Based on this notion, as well as the notion that successful corporate management strategies have a place in fisheries management, it is suggested that a variation of the ITQ management strategy could be applied to Maryland's public oyster fishery. Such an application would potentially meet with less resistance from watermen and legislators, be more compatible with the fishing communities' value system, empower the watermen to determine their own destiny and at the same time take responsibility for their own fishery, their own livelihood. The role of the state fisheries managers and biologists could shift more toward one of advisement, providing the expertise necessary to conduct disease incidence assessments,

population surveys, and water quality analysis. Cooperative management strategies between government and fishers have been successful elsewhere and could be applied to the Chesapeake Bay oyster fishery. Part of this advisement role of the government's would be to recommend when to close the oyster grounds to any harvesting to allow disease resistant or disease hardy oysters enough time to spawn and produce the next generation of disease resistant oysters.

Embedded in the goal to rebuild the oyster fishery are three missions, which are (a) to protect a traditional way of life, (b) to increase the commercial oyster harvest, and (c) to restore the oyster's role in the Bay's ecology. If the pattern of increasingly low harvests continues for many more years the Maryland fishery will collapse, as it did in New England. As the old adage goes, "He who ignores history is bound to repeat it."

A community-run, cooperative fishery challenges the notion that fishers will always be locked into the tragedy of the commons unless there is government control. Given the failure of government to regulate fishing successfully, a self-regulated fishery may be an idea whose time has come on the Chesapeake Bay. The success of the fisheries on Matinicus Island, Newfoundland, Mississippi River, and Norway are but a few examples of self-governed fisheries that work. As has been shown in corporate America, those who have the most to gain or lose in the fishery, should bear the greatest responsibility and cost. Reliance on government funding and programs has clearly not been successful in increasing oyster production or restoring oyster habitat. If anything, government efforts, however well intended, have made it possible for watermen to continue to over exploit the fishery on which their very livelihood depends. The watermen capture the benefits while the harm caused by overharvesting and habitat destruction is shared by all taxpayers, regardless of their share of the impact.

Change is needed, and it is needed now. However, to embark upon any fisheries management plan without considering the nonmonetary benefits and community values derived

from the fishery is to meet with failure from the onset. Unless a management strategy meshes, however tenuously, with these influencing factors, the watermen will not buy in to it. The oyster fishery is a traditional industry facing pressing challenges in a modern world. Whether it is up to the challenge may depend on if attitudes and sociopolitical influences can change, or whether barriers to innovation and entrepreneurialship remain.

## Privatization is a Strategy Struggling for Acceptance in Maryland

1. What social influences have hindered the acceptance of private cultivation of oysters in Maryland?

More than a century's accumulation of scientific insights, commission recommendations, and general popular support of private oyster culture has been ignored to a great extent in favor of political sensitivity to an influential, vocal minority. In the Chesapeake Bay the oyster fishery takes two forms, the public fishery that harvests from the natural bars and the private fishery that farms Bay bottom that is leased from the state. The difference is as much philosophical as it is economic. The watermen, and those who seek to preserve the image their lifestyle invokes, argue that the Chesapeake Bay provides the last place where someone can earn a living from nature's bounty, and that the watermen represent a spirit of American individualism.

This has proven to be a powerful argument, powerful enough to act as a barrier in the legislature to incentives for Maryland oyster farming. Dire predictions about the future of the fishery have not persuaded fisheries' managers or watermen to take a different course. Despite age-old and unsupportable arguments to the contrary, any new technologies or management strategies that could benefit a private oyster fishery would also benefit the public fishery.

Also of important consideration is how the livelihoods of small-boat fishers, such as the Chesapeake watermen, are rooted in the community. Generally, the mind set and dynamics of

fisheries management policies give little recognition to the fact that for many people in these community settings, fishing and Bay resources are as much expressions of social and political relationships as they are about economics and property (Davis & Bailey, 1996). The resistance to leasing is often expressed as concern about its meaning for community and family life, of fisheries management policies that might provide income advantages for a select few while excluding most from a share of the benefits. The nature of the conflict between watermen, scientists, and fisheries managers over leasing reflects the differing understanding of property rights.

However, the fairness and equity rhetoric can frequently be used to mask pursuit of self-interest and protection of a power base, particularly in local community settings, where status and favoritism are embedded. Leasing in Maryland, and particularly the notion of leasing to corporations, is perceived as a threat to the existing power structure among the watermen. Leasing of potentially productive ground means that there will be others excluded from the use of it (Davis & Bailey, 1996). Yet, the excluded watermen's view of fairness may express little more than a desire to be allowed entry to reap the benefits, rather than some commitment to a notion of broadened social equity.

Without appearing to present too cynical a view, one needs to be reminded that traditions, as in cultural practices, are rarely benign, and are frequently conjured up in the employ of present-time social and economic special interests. Certainly, the social and economic relations of exploitative appropriation both within fishing communities as well as between fishing communities are as amenable to being interpreted as traditional as are resource boundaries (private versus public oyster grounds), and use (gear, season) practices (Davis & Bailey, 1996).

In 1916, Green, Revell, and Maltbie presented a sociopolitical analysis of the watermen's

attitudes toward private oyster culture that is as true today as it was then. They noted that three of the beliefs of the watermen shaped the legislation that was enacted:

a. Natural oyster beds belong to the people of Maryland and that harvesting from these beds is a privilege to be reserved for Maryland citizens only. It was and still is a common attitude among the watermen that the oyster fishery is an ancient privilege that cannot be taken away under common law rights and that the public has an unrestricted right to the fishery (Leffler, 1987a).

b. There is a fear that there would be a monopoly by some corporate entity of the leased grounds. Watermen value their status as independent, self-sufficient workers. At the heart of the opposition to leasing is the fear of not only losing access to the oyster grounds but of losing independence, and of becoming hired hands for large corporations (Leffler, 1987a). Though the Haman Oyster Act and its prohibition to leasing oyster bottom to corporations are still in effect today, the majority of watermen do not believe that industry can effectively be kept out, and that if leasing is allowed at all, it opens the door for a potential take-over. Local communities oppose the leasing of bottom for oyster farming because they also believe that large numbers of jobs would be lost (MacKenzie, 1989). However, proponents of leasing see it a different way. Rather than limiting one's independence, a leaseholder is better able to control one's survival in the industry, harvest when one wants, hold oysters until the market prices go up, and so forth. In addition, rather than depending entirely on Mother Nature to take care of things, one can try to create optimal growing conditions by choosing where and when to seed, minimizing siltation, and choosing when to harvest.

c. Most watermen erroneously rejected the idea that oysters could be grown on anything but natural oyster beds. Thus, any leasing strategy would have to include natural oyster beds, thereby restricting where the watermen could harvest. This notion has repeatedly been proven

wrong all over the United States' coast. Much of the successful oyster culture that is being done today in Washington and the Gulf states is done on artificial oyster reefs, in areas where oysters never existed before. In other words, the watermen rejected the state's definition of barren bottom erroneously believing that it would have to include natural bottom to grow any oysters at all (Leffler, 1987a). Indeed, recent experimentation with artificial reef materials in the Chesapeake shows great promise as a future oyster habitat. A clear advantage is that the artificial reefs keep the growing oysters off the silt-laden bottom.

2. How have past and present oyster fishery regulations encouraged or discouraged private cultivation of oysters in Maryland?

The continuing distrust of the government by the watermen suggests that they were, and still are, concerned that privatization would redistribute their perceived natural rights to employment and income in the fishery to a wealthy class of planters. The prevailing attitude amongst the watermen is that an open-access type of fishery is an entitlement, if not a right defined by law.

Maryland is the only major oyster producing state in the United States in which private cultivation plays such a minor role in production. The Maryland legislature has provided few, if any, incentives to potential leaseholders to make such a large economic and time investment into aquaculture. In addition there is no established means in Maryland for financing or providing financial assistance for such potentially risky operations, especially with the hovering specter of oyster diseases. Corporations might have the financial stability to undertake oyster farming, as they have done in New England, and on the West and Gulf Coasts, but century-old restrictions prevent the DNR from leasing grounds to businesses and limit the number of acres each individual can lease.

Watermen have continued to bring pressure on their state representatives in the Maryland General Assembly to protect them from any legislation that encourages leasing. The tidewater counties, those bordering the Bay or its tributaries, have enjoyed excessive representation, for their numbers, in the general assembly, with legislators being very sensitive to the watermen's demands. Such sensitivity persists today even though the watermen and their sympathizers remain a numerical minority but a political majority (Alford, 1973; Kennedy & Breisch, 1983). In short, the legislature ignored, and still ignores, scientific studies and the recommendations of the Oyster Commission, now the Tidewater Administration. The legislature's caving into the demands of the watermen, who have endeared themselves to the public for their traditional way of life, has contributed to the decline of the oyster industry in Maryland (Powers, 1970).

Long years of opposition to oyster farming has hampered development of hatcheries and seed areas, and seed still remains scarce for both public and private grounds. This shortage has proven especially troublesome for oyster farmers since seed oysters raised on public grounds cannot be sold to private planters until a determined amount of bushels of seed has been moved to public beds, to be made available to the public fishery, as part of the repletion program. Unlike Virginia, Maryland restricts the size of leaseholds and only recently permitted the sale of seed from Maryland to growers at a lower cost than the seed previously purchased from Virginia. Until this recent change, it was very unprofitable for private growers to attempt to plant and raise oysters on leased grounds in Maryland.

The sporadic and underfunded efforts at rehabilitation of the oyster fishery have been of minimal value because of the sociopolitical resistance by watermen and legislators. The historically small amount of leased acreage compared to public acreage in Maryland is ironic because, as noted before, Maryland was one of the first states to recognize private cultivation of oysters with the One Acre Act in 1830. To opponents of oyster farming the poor showing of

private planting shows how oyster farming in the Chesapeake Bay has failed. To proponents of oyster farming, the poor showing is an indication of how legislation has successfully hamstrung a viable industry in Maryland. One consequence of this conflict is that the start-up costs for a would-be oyster farmer today are considerably greater than if an oyster farming industry had been cultivating grounds over the last century (Leffler, 1987a). The incredible political influence of the watermen and their sympathizers has prevented any legislation that provides sufficient incentives for a major increase in oyster farming.

Though private leasing of barren ground was provided for in the Haman Act of 1906, this law also included many provisions that inhibited private cultivation. Most of these restrictive provisions are still in place today and the lack of adequate enforcement against poaching exacerbates the situation. Perhaps the greatest disincentive to private planting is the clause that permits legal challenges to the lease. It in effect makes all leases applied for subject to challenge and dismissal, or refusal.

Even though oyster farming is encouraged in Virginia, ever since disease infected the oyster population in the 1960s, farming has declined. Few people want to risk investing money in oyster farming because of the high disease incidence. Instead, Virginia's oyster growers have been aggressively pursuing the notion of introducing the Japanese oyster, which appears to be more disease resistant than the Eastern oyster (Abrahms, 1992; LeGrand, 1997). However, introduction of nonendemic species, anywhere, is fraught with problems of its own and that issue is still under debate.

Despite over a 100 years of recommendations by fishery biologists and economists to privatize all the oyster grounds, watermen, legislators, and the general public have not accepted their advice. Instead, in the past 3 decades, both Maryland and Virginia have developed new initiatives to increase oyster production on the public grounds (personal communication, Gary

Smith, DNR, Oxford, MD, October 29, 1996; personal communication, Louis Wright, DNR, Mattapeake, MD, August 27, 1996; personal communication, William Hargis, Virginia Institute of Marine Science, Gloucester Point, VA, March 1995). During the 1970s, Maryland invested large sums of money in the development of seed oyster beds and the transplant of that seed to areas where the seed oysters would grow to market size, all within the boundaries of the public grounds. This practice continues today at great expense to the Maryland taxpayers, averaging greater than $1 million a year. In Virginia in the mid-1980s, seed transplanting between public grounds was increased. Changes in the cull size at this time permitted harvest of small oysters from public grounds in the James River (Applied Marine Science, 1988). These decisions reduced seed availability in Virginia and raised the cost of seed for Virginia's private planters, in the long-run interest of promoting public grounds production.

In both Virginia and Maryland, increasingly tighter state budgets have cut the amount of money spent on repletion programs on public beds. Most of the Maryland harvest is coming from grounds that have been planted by the state and Maryland's oyster fishery has become what many call a *put-and-take* industry: the state puts, and the watermen take. Harvests in 1987 from the entirely privately controlled oyster fisheries in Oregon and Washington states surpassed the total harvest (private and public combined) in the Chesapeake Bay for the first time ever. While West Coast harvests continue to exceed the Bay's harvest, attitudes toward leasing in the Bay are not expected to change soon. The Chesapeake Bay has lost its supremacy as the premier oyster producing region of the nation and now, even the survival of the oyster fishery is at stake.

Policy for management of the Chesapeake Bay oyster grounds has been determined by the Maryland Legislature, which faced two seemingly conflicting goals. One objective was to maintain wide access to the Bay's natural productivity in order to preserve income-earning opportunities for residents of tidewater communities. The other objective was to increase

production.

3. How has the economic burden of private cultivation deterred increased cultivation of oysters, or are other factors at work?

The combination of disease and the rising cost of seed have radically reduced the potential profitability of private leasing, in addition to the already unfavorable regulations and lack of enforcement against poaching (Bosch & Shabman, 1990a, 1990b). As Maryland looks ahead to revitalizing its oyster fishery, the calls for privatization of the common grounds are being made again (Leffler, 1987a). However, the track record of the oyster fishery suggests that any change in property rights will not be toward increased privatization. The failure to completely privatize the grounds in the past, as New England and the West Coast have done, was not because the transactions costs of doing so were too great, but rather because of the desire to preserve the traditional concept of the commons and the cultural values that would be lost with privatization.

Any changes in the future will likely be toward changing the rules of management and harvest for the public grounds. If oyster production is to be increased in the Chesapeake Bay, the cooperation and consent of the watermen are needed for any policy to be successfully implemented. For the Chesapeake Bay oyster fishery this means designing strategies and policies for improving placement of shell, increasing seed production, regulating gear on the public grounds, establishing quota and season limits, and minimizing damage from disease (Bosch & Shabman, 1990a, 1990b; Shabman & Thunberg, 1988). All of these can be done within the context of a mixed fishery (private and public), or a public, limited-access fishery.

The efficiency of a private property rights structure over property rights of the commons has been the central focus of natural resource economics since Gordon's article (1954) on the

economic theory of a common property resource. It was later popularized by Hardin (1968) when he called property rights of the commons the *tragedy of the commons*. Gordon used a fishery as an example of a common property resource that would be more efficiently managed if privatized. In his model, a common property rights structure attracts labor and capital, which could earn a greater return in private enterprise elsewhere in the economy and in the dissipation of resource investment costs. Conversely, according to Gordon's model, when private property resource investment costs are maximized, labor and capital are released to earn equal, or greater returns in alternative employment. In his analysis, Gordon used only two categories of property rights: private property and common property. This two-part classification, and the resulting conclusion about the efficiency of the alternative rights structures over common property has been widely adopted in the economics literature (Agnello & Donnelley, 1975, 1984; Bell, 1972; Christy, 1964; DeMeza & Gould, 1987; Scott, 1955, 1979).

Over time, the central theme of this economic literature has become prescriptive. Economists advocate the social superiority of private property rights arrangements and support state action to privatize fishery and other natural resources. The Chesapeake Bay oyster fishery has frequently been used to illustrate the validity of Gordon's (1954) model since the oyster grounds are divided into public grounds and private grounds, and the fishery lends itself to this type of comparison.

However, more recently, economic assessments of common property rights systems are being accompanied by new insights that are leading to a reexamination of conventional economic theory and policy prescriptions (Feeney, Berkes, McCay, & Acheson, 1990; Pinkerton, 1989; Quiggin, 1988; Santopietro & Shabman, 1992b). One of the reasons for arguing that a type of commons management strategy may be more efficient is the notion of nonmonetary returns (Swaney, 1990). In the fisheries literature, there is a growing recognition that specific,

individual returns are realized from common property ownership. Some of these returns by their very nature, exist only when the resource is a commons and would be lost with privatization of the resource (Apostle, Kasdan, & Hanson, 1985; Pollnac & Poggie, 1975; Smith, 1981), such as the loss of traditional values derived from a community structure that would be disrupted with abandonment of a commons fishery, should be included as a cost of privatization.

The oyster fishery of the Chesapeake Bay provides an excellent situation within which to reexamine the conventional fisheries economics theories and policy prescriptions that emphasize the economic superiority of private property rights. This is particularly useful since property rights, or use rights, determine the methods and extent of resource exploitation that is permissible by those with access.

Although the development of the private oyster farming industry on a large scale has been known for over 100 years throughout the world, seed oysters for planting have been raised artificially upon a small scale in Italy for more than 1,000 years by a very simple method. Pliny, *The Elder*, wrote (as cited in Brooks, 1891) that the artificial breeding of oysters was first undertaken by a Roman knight, Sergius Orata, in the salty waters of Lake Avernus, and that enterprise was so successful that Orata became very wealthy (Gaius Plinius Secundus lived 23-79 CE). Orata would pile up stones on the bottom of the lake, high enough to keep the oysters off of the lake's mud bottom. Upon these rocks oysters taken from the sea were placed to provide spat for future harvests and the breeding oysters themselves were not harvested. Each pile of rocks was surrounded by a circle of stakes that were connected to each other by a cord. From the cord a small bundle of twigs was suspended so that it hung in the water near the bottom. During spawning season, the swimming veligers attached themselves to the twigs and grew very rapidly. As the oysters grew to a suitable size for market, they were removed from the twigs and the smaller oysters were left to continue to grow. Variations on Orata's technique, some with more

or less success, are used today throughout the world.

A new pioneering project, only a few years old, run by the Virginia Institute of Marine Science (VIMS) in Gloucester Point, Virginia, is based on the hypothesis that oysters might grow better farther up the water column instead of on the sediment-laden bottom (Williams, 1997). It was first tested by VIMS over a 10-year period during which the scientists and volunteer watermen discovered that if the oysters were grown off the bottom in trays, they would not expend as much energy ridding themselves of bottom sediments, and they would be in a part of the water column that has higher concentrations of phytoplankton and dissolved oxygen. This is a modern day version of the Roman knight Orata's oyster farming technique. If the oysters grew faster under these conditions, they might reach the legal harvest size (3 inches) in less than the 2-3 years in which Dermo and MSX usually kill them. Now, small-scale Virginia oyster farmers can purchase certified disease-free (not necessarily disease resistant, not genetically-manipulated) seed oysters from the VIMS hatchery and grow them suspended in trays or mesh bags. The rapid growth rate of the suspended oysters does not appear to have affected their flavor (for which Chesapeake Bay oysters are famous) but, it has produced thin shells so shuckers and packers need to take extra care with the oysters. It will take a while before this project, if it continues to be successful, reaches commercial scale or there are enough oysters to make a noticeable difference in the Bay's water quality. It does, however, show promise and whether it becomes a cost effective endeavor for the growers only time will tell.

For many years fish hatcheries in general have served two purposes, as a selective breeding ground for only those characteristics that are desirable, and as a restocking tool to bolster sagging or declining populations of fish. The earliest known, federally built hatchery was in Bucksport, Maine, built in 1871 in an effort to replenish declining stocks of Atlantic salmon (Kenworthy, 1996). Though many hatcheries originally were started to provide stocks for

recreational fishers, they have now, out of necessity, become scientific laboratories for commercial fisheries to deal with the ever increasing specter of disease running through fin and shellfish populations. The state funded oyster hatcheries in Maryland have attempted to find a cure for MSX and Dermo by not only exploring their mechanism of action but trying to breed disease resistant oysters. The oyster hatchery program has a long way to go before disease resistance can, if ever, be truly established and enough oysters are raised to be of commercial note. The repletion program is in itself, a version of a restocking program not unlike those carried out with finfish, only the oyster stocks are not hatchery reared.

Though the Maryland state budget once relied heavily on the taxes and secondary industries (restaurants, shuckers, packers, shippers) that oyster fishing brought to the state, now the state pays far more into the fishery than is returned. Even with unlimited funding for research, the creation of a genetically-manipulated miracle oyster that is disease resistant, salinity adaptable, pollution tolerant, and fast growing will not solve the problems created by mismanagement, misguided actions, and greed if fisheries management strategies are not changed.

In addition to the tremendous costs incurred by hatchery rearing and restocking programs, a growing number of fisheries biologists and conservationists are lobbying nationwide to reduce the country's reliance on state and federally funded programs, saying that they do more harm than good, both socially and biologically (Kenworthy, 1996). Excessive reliance on hatchery rearing and restocking programs, sometimes referred to by conservationists as *mitigation narcosis*, many researchers have found, often leads to a loss of genetic diversity and the spread of disease. Ultimately, they say, it can cause an overall reduction in fish populations as hatchery-raised stocks initially out-compete wild populations but later succumb to other conditions that the hardier wild stocks were better able to adapt to because they have not had a

coddled upbringing in ideal hatchery conditions. As the evidence piles up, fisheries managers are torn between science and politics, most notably the demands of their fishing constituencies. Unfortunately, as state and federal fisheries managers all over the country have found out, once a fishery becomes dependent on hatchery rearing and restocking programs, it is difficult to terminate them. A major shift is needed from producing fin and shellfish for harvest toward protecting fish habitats and declining species.

The historical objectives of policy makers in Maryland and Virginia have been to both maintain wide access to oyster grounds in order to preserve the traditional distribution of income from this source, but also to increase production. The current mix of private and public, state-managed grounds was established around the turn of the century in order to promote these objectives. This mix is the result of a political consensus that both protected rights of access for the watermen by reserving the natural grounds as a commons, and at the same time granted exclusive rights to those willing to invest in private cultivation. The initial success of Virginia's private planters in increasing production led biologists and economists to argue that complete privatization in both Maryland and Virginia is the best course of action for increasing oyster harvests from the Bay. Recently, however, disease outbreaks more serious than in the past have devastated the Virginia oyster grounds, both private and public. Calls for complete privatization as a management strategy have consequently waned because this recent rise in disease incidence has discouraged, and will contnue to impede, any investment in private planting.

Complete or substantial privatization of the Chesapeake Bay oyster fishery, at this point, would likely favor those with the capital to invest in leasing, cultch, and seeding. The private property rights structure of the successful, commercially viable oyster fisheries of the West Coast, Gulf Coast, and New England have evolved over a great many years in areas where little or no oyster fishery existed before, or where the public fishery collapsed early on. They were not

encumbered by over 100 years of tradition and fishing on the commons. Community structures and values have evolved over many years around the Chesapeake Bay because of the existence of the commons. Drastic legislative changes would be needed to allow for, and provide incentives for, leasing including relaxing the ban on corporate leasing and leasing of natural ground, as well as providing protection from poaching and providing adequate seed supplies at an affordable price. Even if such legislative changes were made, as long as the specter of disease looms over the Chesapeake Bay oyster fishery it is unlikely that many will be willing to invest their money and efforts into farming oysters. Overfishing, habitat destruction, and pollution are contributing factors in the disease susceptibility of the Bay oysters and until those problems are dealt with in a comprehensive fishery management plan, it is likely that MSX and Dermo will plague the Bay's oyster populations for many years to come.

4. How do nonmonetary, intangible benefits provide watermen with sufficient compensation for the monetary loss incurred by working in the oyster fishery?

The value watermen place on their jobs and on their quality of life is not taken into account as an opportunity cost if, as NRE economists define it, the more efficient system of private property rights is adopted because quality of life is a subjective matter. One component of this value is the satisfaction the watermen obtain as self-employed fishers. Owning one's own boat and gear gives a waterman a sense of independence not readily available in other areas of employment (manufacturing, construction), or in working for an oyster farmer. Working out of doors, close to nature, taking risks, and following family and community traditions have all been found to be important in providing job satisfaction to the Bay watermen. The value of nonmonetary, intangible benefits, called *worker satisfaction bonus* (WSB) by Pollnac and Poggie (1988), depends upon the preferences and attitudes of the individual watermen. With other

sources of employment potentially providing higher income and job stability, the value of the WSB is clearly very high for many of the watermen, especially the long-time watermen. Despite the declining harvest, the WSB apparently sufficiently compensates them for the monetary loss incurred by working in the oyster fishery.

A potential opportunity cost that could be displaced from the fishery by privatization would be the quality of life enjoyed by the watermen and their families who live in small, distinctive communities along the many inlets and tributaries of the Chesapeake Bay. The fishing communities are characterized by tightly-knit, extended-kinship interactions because of the limited in-migration of new people during the last 2 centuries. The traditional use of small boats and the generally greater abundance of oysters in shallow coastal waters usually allow watermen to work close to home, and at the same time secure a living that supports their families and the community structure. Most watermen have lived in their communities for more than 20 years, and this attachment to the local community is a strong motivation for maintaining access to the public grounds for a large number of people. This commitment is further intensified by the fact that there are few alternative employment opportunities in these local, rural communities.

The watermen have historically believed that individuals and corporations wealthier than themselves would acquire most of the property rights if the commons were abandoned to privatization. The current property rights structure, in which only barren grounds are available for lease, keeps the private and public fishery distinctly separate, and has for over 100 years. If, as the watermen fear, the public grounds were made available for lease, the watermen might be left with the alternative of either working as wage laborers for the oyster farmers or leaving the fishery. Thus, they continue to oppose any moves toward increased or complete privatization of the fishery, where the gains flow elsewhere in the economy (owner of the lease) rather than back to those currently sharing in the commons. More importantly, the watermen continue to oppose

privatization because of their interest in maintaining the benefits that the commons support, such as WSB and preservation of the community structure.

The oyster fishery management system of the Chesapeake Bay has been described by economists as legislated inefficiency. The justification for this belief is based on both theory and empirical investigation. However, both the theory and the empirical work suffer analytically because they are based on the assumption that the public grounds are an open access resource, when in fact they are a limited-access resource and are heavily regulated, with restrictions that limit both access and use, and they are actively managed by state agencies. The conclusion that private oyster grounds are more efficient in the neoclassical sense than the public grounds misses the fact that the rights structure is part of the political consensus on managing the fishery. The oyster grounds are neither fully privatized nor open to all fishers without restriction and more than resource investment costs are at stake. The mix of private and state-managed public oyster grounds reflects a public policy of trying to maintain a certain distribution of income from the fishery while also increasing harvest levels. Unfortunately, the existing rights system has been decidedly ineffective on production. Under the existing common property rights structure and continuing decline in the oyster population, financial and even nonmonetary losses are increasing for the watermen.

The various measures of job satisfaction are complexly related to other sociocultural variables such as age, years of fishing experience, type of fishing, ethnicity, and home port or community. The changes brought about by fisheries management can take many forms ranging from minor alterations in the harvesting techniques used to drastic shifts in style, or possible displacement of individuals from the industry due to limited entry plans. These changes, no matter how minor, have the potential of affecting the structure of a person's work, an aspect of life that has been shown to play an extraordinarily important psychological, social, and economic

role in the well-being of the individual in American culture (Gatewood & McCay, 1990).

The fisheries manager's interest in determining how social and cultural characteristics of people relate to their satisfaction with, and performance in, changing occupational roles can be useful in developing an understanding of some of the potential sociocultural impacts of specific management strategies as applied to a commercial fishery. Therefore, it is prudent to address the structure of job satisfaction in the Chesapeake oyster fishery by using existing theory to propose practical solutions to the problem of developing fisheries management strategies that minimize negative social consequences while conserving oyster stocks and economic viability.

Resource management, in the biological sense, involves the management of ecosystems and natural areas in an effort to maintain biodiversity and to protect species. However, incorporation of cultural, social, and historical issues in natural resource management also obligates resource managers to reevaluate resources, and accept culture as a viable input within the realm of interpretation and protection. Resource managers must understand cultural differences and dominant patterns of resource allocation as they affect, and are interpreted by, other cultural groups. People's views and interpretations of their surrounding environment are affected by cultural norms. There are regional differences interwoven with these cultural differences between the fishers of different types of fish, or shellfish. For example, oyster fishers in the Gulf Coast fisheries (Galveston Bay) are culturally different from the watermen of the Chesapeake Bay, which are culturally different from the New England oyster fishers (Wang, Anderson & Jakes, 1996).

There are two factors that need to be included in fisheries management models that are normally missing: (a) fishing is an enjoyable activity with intangible rewards in addition to revenues, and (b) one's perception of the costs involved in an enjoyable activity tend to underestimate real costs. Therefore, the level of fishing effort at which the greatest profits are

obtained is not necessarily the point at which the greatest overall rewards are to be had. The inclusion of a satisfaction bonus (positive nonmonetary rewards derived from the activity of fishing) in a fisheries management strategy would likely indicate that a management objective of OY would allow somewhat greater fishing effort than one based on MEY. One must caution that management for OY may yield slightly lower profits and may exact a greater toll on the oyster stocks, thereby compromising the long-term sustainability of the fisheries.

Regardless of whether fisheries managers are using purely economic models or are using socioeconomic models, both types of models agree that unless the oyster fishery is regulated in some manner, if competition for the common-property resource persists without some controls, the fishery will be exploited to unsustainable and therefore socially suboptimal levels. Since fishing has considerable nonmonetary rewards, fishers do not stop fishing when the purely economic models of fisher's motivations predict they should. In some cases, they even subsidize their fishing with other income. For any fisheries management plan to work, fishers' satisfaction bonus must be taken into account, and management targets and tactics adjusted accordingly.

In the Chesapeake Bay fishing communities, fishing is not just a job, it is a lifestyle, a history, a culture, passed from one generation to another. Hence, any attempts to initiate change that is perceived as a threat to tradition will be met with highly charged emotional debate, political jockeying, and resistance tactics. Instead of action, those who are trying to implement change will be met with a barrage of rhetoric, endless emotional posturing, plays for sympathy, questions, and non-verbal behavior that diverts attention away from the real goal of producing needed change.

5. How can a single property rights management scheme be suitable for all oyster fisheries?

There is evidence to suggest that the tragedy of the commons is neither universal nor inevitable. In small-scale fisheries such as those in Lofoton, Newfoundland, the Mississippi River, and Maine, local fishers manage communal fishing grounds, usually without much government interference, and they are successful in preventing overfishing. For the most part, these arrangements are community-based, spontaneously developed, and informally organized. Though they may carry a common thread of community-based management, these fisheries are very different from each other, in culture and management strategies. The very existence of these fisheries challenges the notion that fishers are necessarily locked into a self-destructive pattern of competition that invariably leads to severe depletion of the resource. Their existence illustrates the fact that a fishery of the commons can be self-regulated. This community-based approach is designed to be responsive to the diversity of factors that exist among fishers and fishing communities, and the long-term survival of the community and the fishery. To develop more place-based, effective fisheries management strategies, it is necessary for fisheries managers to change their basic assumptions regarding the environment of small-scale fishers. Managers must understand the diversity in the social and economic structure of the communities in which production and marketing take place, and the extent of the resource base. In other words, fisheries management strategies can be tailored to the community and the fishery, which are in fact, intertwined. It combines the goals of fisheries management and rural community life to find solutions to both specific problems faced by fishers and the underlying causes of the problems.

Though oyster farming has long been successful in the Pacific, Gulf, and New England states, cultural and financial barriers impede its introduction and success in the Bay. It is important to point out that the oyster fishery of adjacent Delaware Bay is a mixed (private and public) fishery plagued by the same diseases, weather, and pollution problems as the Chesapeake

Bay. However, there have been far fewer barriers to leasing than in Maryland, the oyster fishers do not rely solely on the Delaware Bay for their livelihood, and there is no equivalent of a repletion program or any other subsidy. Left mostly to their own devices, the Delaware Bay oyster fishers have found other means of income and, therefore, put less pressure on the oyster stocks.

In the context of formulating regulatory policies for each unique fishery, consideration must be given not only to how to achieve conservation and economic goals, but also the specific nonmonetary rewards of fishing as these vary among different fisheries and regions. Because the total configuration of incentives and rewards is fishery- and region-specific, it is both naive and misguided to think that there is a single, best way to regulate fishing effort, for there is no regulatory strategy that applies equally well to all fisheries in all regions.

## Recommendations

### Avoiding the Tragedy

All up and down the East Coast, from the Maritime provinces to the Gulf coast, severe overfishing is leading to the economic and environmental ruin of most of the fisheries. As one species is fished out, the fishers concentrate their efforts on other species. In spite of years of governmental restrictions on gear, catch, and seasons, fishers are continuing to exploit the once productive resource that their livelihoods depend on.

In his ground-breaking and influential article, Garrett Hardin (1968) explained why a natural resource open to all is subject to over exploitation. He used as an example a pasture open to all herdsmen for cattle grazing, in other words, a commons. Hardin pointed out that eventually the pasture will become overgrazed. The reason is that each herdsman can capture all the benefits of adding more cows, while facing only a fraction of costs, such as the harm caused by

excessive grazing, since all users share the costs regardless of their portion of the impact of overgrazing on the pasture. The tragedy, noted Hardin, is that each individual is locked into a system of competition for grass, which leads to ruin.

A similar tragedy occurs when a fishing territory is open to all fishers. Each fisher captures all the benefits of harvesting for fish, while facing only a small part of the costs, such as destruction of habitat and the reduction of the fish population for future harvest. Such was the case in the Maryland oyster fishery in the late 1800s, which prompted William Brooks (1891) to write:

> The citizens of Maryland do not desire to deprive any one of the right to earn his living, but our own interest requires that oystering upon the public beds shall be prohibited unless the oystermen can convince us that they can be intrusted with this right, without placing our common property or the property of any citizen in peril. The question which we should ask them, which they are bound in justice to ask themselves, is whether they are able to give this assurance to the people of the State. They cannot satisfy the community by calling for more laws to keep them within bounds, or by asking for an armed police force to prevent them from destroying their own interests.
>
> They must satisfy the people that they themselves have enough public spirit to organize themselves for their own government and regulation, and that they have enough self-restraint and forethought and intelligent self-interest to provide for the protection and improvement of the property which is entrusted to them. (p. 213)

If William Brooks could step forward in time, he would find that his words hit the mark as accurately today as they did over 100 years ago. Clearly, it is the lack of being held responsible for the success of the fishery that perpetuates the continued overharvesting and destruction of Maryland's oyster fishery. In other words, as long as the government takes responsibility for the success of the fishery while the watermen are not held responsible for preserving the stocks and habitat, the watermen will continue to exploit the fishery.

## Partnerships Instead of Us Versus Them

In order to ensure sustainable harvests of oysters and avoid the previously discussed

tragedy of the commons, sound, enforceable management practices are needed. Generally, it has been assumed that fisheries management is entirely a government responsibility. Various management strategies have been used, including licensing systems, harvest quotas, and other control measures (Jentoft, 1989). However, information from both state and federal regulators shows that very often these management strategies have met with mixed success. In fact, fisheries management has less to do with understanding fish than with understanding and working with people (Dyer & McGoodwin, 1994).

Government-fisher interaction can take many forms. The degree of fisher involvement and the locus of decision-making power may differ from one fishery to the next and from one state to the next. Correspondingly, the organizational set up may vary. The two extremes are government power and fisher power (McCay, 1995). Fisheries management systems generally fall somewhere in between these two extremes. Two general alternatives are available for the institutional design of user involvement; consultative management and cooperative management. The characteristics of both have been discussed and compared (Chapter 2, Literature Review). Cooperative management, or co-management is closer to the fisher-power end of the scale, and has some promise in giving people in the fishing industry and in fishery-dependent communities, a greater say and responsibility in fisheries management. Cooperative arrangements may be delegated from central government to local-level institutions or result from a legal recognition of traditional, community-based management (Jentoft & McCay, 1995; McCay & Jentoft, 1996). The basic principle of cooperative management is self-governance but within a legal framework established by government, and the power is shared between the fishers and government.

The role of science in fisheries management is central but problematic for several reasons:

1. Natural resource management is based on the notion that it should be first and

foremost informed by science and that this best serves both public and user group interests.

2. Advocates of scientific guardianship in fisheries management do not take into consideration that learning is an important by-product of participatory democracy (McCay & Jentoft, 1996).

3. Neither do they recognize that user participation is a contributor to greater legitimacy of the regulatory system, which in turn promotes higher compliance.

By involving fishers more directly in the decision-making process and by bringing the management process closer to the fishers who are affected, their willingness to come to agreement and comply with the rules and regulations is enhanced.

In some countries, the efficacy of cooperative management systems as a management tool have been successful by delegating management responsibility to fishers' organizations. In these cases, fishers' organizations take an active part in designing, implementing and enforcing fisheries regulations.

In fisheries management, governments usually choose between two general options: indirect regulation and direct regulation. Indirect regulations try to control the total harvesting effort by regulating the number of participant fishers, the size of their boats, and/or the number and type of the fishing gear. Territorial and seasonal regulations, which restrict fishers' access to fishing grounds at certain periods of time also belong to this category. While indirect regulations try to control the inputs of person power and/or capital, direct regulations seek to limit output. Fixing a level for a *total allowable catch* (TAC) is one way. Dividing the TAC into individual quotas (per fisher or per boat) is another (Jentoft, 1989). When considering alternative management strategies for Maryland's oyster fishery, one must weigh the advantages and disadvantages to various strategies and the cultural compatibility of the strategies to Maryland's tidewater communities.

Experiences with indirect regulations are primarily negative. They scarcely obtain the intended results and often produce unintended consequences. For instance, such regulations fail to cope with overcapitalization and resource depletion because they stimulate the adoption of more efficient technology. They can close the door to new entrants and, as a consequence, they establish privileges which make the fishery a rich man's club. Indirect regulations are difficult to administer and enforce, and they also create a very inflexible regulatory system. Once regulations are adopted, they are hard to change. If the government cannot enforce the regulations, then the management strategy has no chance of success, for without involvement by the fishers themselves there is no incentive to voluntarily obey the rules (Waters, 1991). When fishers have a substantial involvement in the development of the regulations, it becomes to their advantage to enforce them and report those who violate them.

Fishers almost always have an immediate economic interest in finding ways to bypass regulations. The result is that the fishers have more incentive than not to circumvent the regulations and promote their own individual interests at the expense of the collective interest. In addition, enforcement of regulations is usually poor at best.

Consensus management is possible through implementation of a participatory decision making structure that demonstrates the relative attributes of various management options, or choices. Such an approach addresses the need to include social factors, confront uncertainty, and allow decisions using the best available data. Complete agreement among competing interests in the fishery may not be achieved, but in the process, scenarios can be developed and evaluated so that a decision by a mediating authority may be based on an analytical evaluation of alternatives, rather than on strictly political concerns.

The fisheries management problems of the Maryland oyster fishery center on the risks to both fishers' capital and to social capital. The problem does not lie in the regulations per se.

Better drafted, more goal-directed, more objective regulations are unlikely by themselves to overcome the problem of not being able to manage fish abundance. Fisheries management has had 100 years of experience in writing unsuccessful regulations as proof of the failure of top down regulations. The tools of business can be applied to what is basically a business problem, which means handing over to the fishing industry itself the responsibility and cost for managing its own risk. "It should not be a government responsibility to pay for the management of profitability of the fishing industry by managing their risk" (Gauldie, 1995, p. 2060). Every business has to overcome the risk inherent in cycles in abundance, and the fishing industry should be held responsible for managing its own risks.

The long-established biological emphasis in fisheries management has meant that the role that fishers play has largely been ignored. Yet people, both those who fish and those who are otherwise involved in the fishery, contribute directly and significantly to the fisheries systems themselves. Among old school fisheries managers and fisheries economists, there has been a tendency to give a rather static role to people, most notably in the form of analysis that takes for granted the eventual destruction of any fishery, following the tragedy of the commons theory formulated by Hardin (1968). According to Hardin's model, where access to a fishery is open, it is not in the interest of any fisher to limit his or her own effort, as this will only enable others to harvest more. Thus, to prevent overfishing and depletion, it is argued by fisheries managers who subscribe to Hardin's model, limitations on fishing effort must be imposed by government authority.

However, the assumptions inherent in such applications of Hardin's model have been extensively challenged by more recent research on local-level, common property institutions for managing resources (Berkes, 1989). During the past 2 decades, in different parts of the world, the widespread existence of local-level, common property-type systems which regulate access to,

and use of, resources have been documented (Cordell, 1989; Ruddle & Johannes, 1990). Most types of locally-controlled coastal resource management systems are of a traditional, unwritten kind, based on local customary law (Ruddle, 1994). Increasingly, the question is asked whether such systems, which include unwritten regulations on access to fisheries areas and stocks, and the use of an imaginative range of technologies based on precise local knowledge of the behavior of the food species, are a practical basis for achieving sustainable utilization of fisheries resources.

Introduced resource management initiatives must be closely adapted to local-level needs and aspirations. Stakeholders' participation at all stages of formulation and implementation is a prerequisite of local fisheries management. The crucial question for the success of any fisheries management scheme is, What measures are needed to encourage fishers to voluntarily advance their collective interests at the expense of their private ones? In other words, what would motivate fishers to adhere to the regulations? A key word here is legitimacy, meaning to what extent do fishers willingly accept the regulations as appropriate and consistent with their values. In essence, legitimacy refers to the degree of acceptance which the regulatory authorities enjoy among the community. If fishers find the regulatory scheme legitimate, there is more reason to believe that they will follow the rules. The question then becomes, how can legitimacy be improved?

Academia and government have long had a strong alliance in research ventures, particularly in the areas of the environment and medicine. However, the mistrust between fishers and government (us-versus-them mentality) has been a major barrier to an alliance of the three. Unfortunately, the destructive practices of fishers, such as overfishing and habitat destruction, are eliminating the very industry that the government and academia are trying to preserve.

Jentoft (1989) suggests that the legitimacy of a regulatory scheme is related to at least

four general hypotheses:

1. Content of the regulations: the more the regulations coincide with the way fishers themselves define their problems, the greater will be their legitimacy.

2. Distributional effects: the more equitably the regulations are imposed, the more likely the legitimacy of the regulations will be regarded.

3. Making of the regulations: the more fishers are involved in the decision-making process, the more legitimate the regulatory process will be perceived.

4. Implementation of the regulations: the more directly involved fishers are in installing and enforcing regulations, the more the regulations will be accepted as legitimate.

Thus, there may be at least four ways to improve the legitimacy of fisheries regulations and to increase their prospects of success. Each requires taking the fishers' point of view into closer consideration. In the first two of Jentoft's hypotheses, the content and quality of the regulations per se are the focal points. The last two hypotheses concern the organization of the decision-making process.

How can the legitimacy, and hence the expediency, of fisheries regulations be improved by involving fishers' organizations directly in the regulatory making process? Participation would in itself tend to advance legitimacy. But in addition, participation should also improve the quality of the regulations. In other words, by organizing the regulatory process (hypotheses 3 and 4), the content as well as the distributional effects of the regulations (hypotheses 1 and 2) should be improved.

Local Control

The existence of locally organized informal fisheries management systems has been well documented by social anthropologists with an interest in fisheries and maritime communities.

The focus of the regulations of the locally managed systems usually take the form of territorial use rights. Here, fishers from the community share implicit agreements on the conduct of the fishery within waters which they consider theirs, and which they actively protect from intruders. Sometimes these regulations are established for reasons of resource protection. Very often their main purpose is to create order and avoid gear conflicts or to ensure fair distribution of access opportunities to the fishing grounds.

Cooperatives can be positive tools in fisheries management, particularly as they relate to small-scale fisheries. Government bureaucracies have a limited capacity to oversee the many local and seasonal variations within different regions and sectors of the fishery. For regulations to be efficiently carried out they must be fair. This however, requires a large amount of detailed knowledge of local circumstances in the fishing industry, the community values, and sociopolitical structure.

Variations entailed in the nature of the fisheries require flexible management systems. A central argument for introducing localized cooperative management is that large government bureaucracies are less flexible than local fishers' organizations working together with local government in enforcing management schemes. In other words, local or regional cooperatives are generally more able to react to a situation more quickly than state, or certainly national, governments. Decisions to change the rules of a fishery can be reached much more quickly by regional cooperatives than by large government.

Delegating responsibility to local cooperatives means that the fishers become active, responsible individuals in the decision-making process. By definition, cooperatives rely on membership participation, which is reflected in the internal structure of the organization. Transferring responsibility for management functions from large state or federal government bureaucracies to local cooperatives introduces more democracy into the regulatory process and

would also be a valuable societal benefit in its own right.

Unfortunately, fisheries management and regulation in Maryland and elsewhere has become very process-oriented. Too much attention has been given to the steps a fisheries management strategy must proceed through, rather than to solving management issues. There is a need for local flexibility and participation by all affected parties in fisheries management in order for any management strategy to be implemented successfully. The affected parties must feel that they have a stake in, and are empowered to participate in, the formation of the fisheries management strategy. In addition, if the strategy runs counter to regional values and culture, its implementation is doomed for failure.

The Maryland legislature often relies on numbers, regardless of how uncertain they are, to make decisions. Unfortunately, the draconian numbers game fails to present an accurate picture of the whole oyster industry and often leads resource managers, regulators, and politicians to reach inappropriate conclusions. High catch numbers do not necessarily translate into high dollars sold. Conversely, a low catch may be sold for a greater amount of money. Supporting industries such as processing plants, packers, and the restaurant business are economically tied to the oyster fishery. Where fisheries economists have failed has been their inability to put a value on habitat destruction and its impact on the fishery. Nor have the economists been able to adequately factor in the nonmonetary benefits to fishing. Though it is admittedly a daunting task with many co-dependancies woven in, the common reaction has been to ignore it (Lee, 1980).

Traditionally, economists have been accustomed to considering pollution and environmental damages as externalities, where the costs are borne by the entire community rather than by the activity itself. Under the current economic structure in the Chesapeake Bay, there are few incentives not to overharvest or destroy habitat. On the contrary, unless there is local

participation by the affected parties to set harvest limits and conserve habitat, then satisfying short-term self-interests without paying the consequences for it confers a distinct competitive advantage on those who harvest at will with little regard to preserving the habitat and oyster population for a sustainable future. To treat environmental impacts as externalities and manage from afar can no longer be justified. Though environmental policy and fisheries management is of state-wide and Bay-wide interest, action should be local, particularly if people are to feel that they have a stake in the outcome.

What appear to be missing from most, if not all fisheries management strategies, has been an adequate line of communication between fisheries scientists, regulators, and the regulated community. The apparent barriers to effective communications appear to be due to cultural reasons. In Maryland, the harvests are so poor that the watermen cannot even meet the catch quotas that the DNR has set. So, ironically, rather than quotas being a restraining factor, they actually encourage the watermen to fish as hard as they can to achieve the quotas, further diminishing the oyster population. There is a disconnect between fisheries biologists sounding the alarm to halt harvesting in some areas and the legislature setting quotas that encourage greater harvesting effort.

If a cooperative venture is initiated between fishers, state managers, and fisheries scientists, it is likely that politics will still play a heavy role. Unfortunately, politics is self-serving and ideologically based. Traditionally, politics deals with issues and not with performance. Maryland politics are based on economic interests and their political integration into government policies and regulations, rather than a performance-based approach that looks at what works for the greater good, and not special interest groups. Just as companies associated in a joint venture must be prepared to abandon old processes quickly, to serve the total venture long-term, so must fisheries managers and the legislature, no matter how traditional or great the

influence from one partner.

The political influence of fishers in the Chesapeake Bay far outweighs their numbers and a disproportionate amount of government legislation is passed or rejected in favor of the fishers' demands, even if it flies in the face of good science and long-term sustainability. In general, governments find it very hard to abandon an activity, even if it has totally outlived its usefulness, or is even counter-productive. A private business can be liquidated, sold, or dissolved when it has outlived its usefulness, but a government activity can live on ad nauseam. In the United States, there are now Sunset laws which prescribe that government activities should lapse after a given time, unless they are re-enacted. However, legislatures rarely refuse to renew an activity, no matter how obsolete or futile it has become. Usually, by that time, it has become a vested interest. The repletion program is one example of this, and the continued ban on corporate leasing is another.

Localized Cooperative Fisheries Management in Maryland: Can it Work?

If fisheries managers recognize the roles and dynamics of goals, objectives, and values in fisheries management, they can better focus limited organizational resources for more effective management of fishery resources. A need for local cooperative management in the Maryland oyster fishery is shown by the noticeable lack of long-term rational goals and objectives, and the lack of recognition of the effect of diverse regional value systems on the entire process.

By definition, fisheries cooperative management means that government agencies, fisheries biologists/researchers and fishers, through a cooperative organization, share responsibility for management functions. The point of departure for initiating cooperative management agreements as part of a political process can vary from region to region. In one case it can mean that the government formally recognizes regulations which are already being

enforced in an informal manner by the fishers themselves. In another, the actual regulatory power is transferred from the government to local fishers' organizations. This would normally be the situation in fisheries where the government already plays a prominent management role, such as the Chesapeake Bay oyster fishery.

Cooperative management is to be distinguished from consultative arrangements, which have been in existence for several years in the United States and Canada. Such arrangements usually involve an advisory board, in which representatives of the fishing industry are consulted by the government before regulations are introduced. Such is the case with the Maryland oyster fishery, where committees of watermen advise the DNR. In contrast, cooperative management means that fishers' organizations not only have a say in the decision-making process, but also have the authority to make and implement regulatory decisions.

Localized cooperative fisheries management can be distinguished from other common property management systems, in that it is a meeting point between overall government concerns for efficient resource utilization and protection, and local concerns for equal opportunities, self-determination, and self-control. The responsibility for initiating regulations is shared.

Thus, though cooperative management agreements are unlikely to be a panacea for solving all the problems of the Chesapeake Bay oyster fishery, when the benefits and costs are taken into account, it must be considered a viable option in comparison to other management alternatives.

Perhaps the most common argument in favor of a localized cooperative fisheries management approach is that cooperative organizations that include fishers are in a better position to make more equitable regulations than governments alone. Not only are fishers' organizations better able to determine what the relevant equity considerations are, they are also more capable of responding adequately to the special needs, demands, and interests of individual

fishers or fisher groups. Governments tend to follow principles of universalism when dealing with client fishers. This may guarantee neutral, but not necessarily fair, treatment. Fishers' cooperative organizations on the other hand, can be more personal, which is sometimes needed to ensure fairness and equal opportunities.

William Brooks's (1891) insight into the management needs of the Maryland oyster fishery of the late 1800s is reflected in the recommendations that he made to the legislature that address today's needs as well as yesterday's, but were virtually ignored at that time:

> If I tell the oystermen that it is useless for them to look to the Legislature for the improvement and development of the public beds, I only tell them what they already know by long experience.
>
> It has been proved conclusively, over and over again, that our public domain cannot be protected without the aid of the oystermen; but if they would co-operate for the enlightened administration of their own business, they would need no new restrictive laws. They do not even need to send men to the Legislature to look after their interests, nor do they need to fee lawyers to make out a case for them. The enlightened sympathy of our people is worth more to them than any number of men in the General Assembly, or than all the advice of the best lawyers in the State. For support they must rely upon public sentiment, and for success they must trust to their own efforts. If our public beds are to be saved from ruin, it must be by the efforts of the oystermen themselves, by organization and co-operation for the purpose. (p. 221)

The long-term effects of introducing cooperative management agreements into the Chesapeake Bay oyster fishery are difficult to predict, as it is with most institutional reforms. The short-term effects may be quite different from the long-term effects and there may be transitional problems. In other words, the prospect of success will be contingent upon the way cooperative management is introduced, incrementally or as a grand scheme.

The most important contribution that can realistically be hoped for is that cooperative management will confer the regulatory process with legitimacy. This will tend to make management both more effective and less costly compared with solely state government control. Crucial to the success of a cooperative management strategy is the actual division of responsibility between government and the fishing industry. The context into which cooperative

management is to be introduced should be taken into account when cooperative management schemes are designed. In a cooperative management plan, all affected parties, be they fisheries biologists, government regulators, fisheries-related industries, or the fishers themselves, participate in the decision-making. Government can have a role in overall planning, scientific support, total quota management, in solving distributional conflicts among various cooperative organizations, or in providing sufficient legal support for the cooperatives. Apart from that, when it comes to fishing practices, access control, and making distributional decisions among individual fishers or boats within a community, local fishers' organizations in general, are well suited to the task.

A common property resource, such as an oyster fishery, will be used to excess when faced with sufficient demand. This will lead to exploitation, resulting in the depletion of the stock. By internalizing the cost of regulation, monetary and human resources can be allocated more efficiently, with increased productivity of the fishing grounds/habitat and lowered costs due to economies of scale (Pompe & Rockwood, 1993).

The inflexibility and ineffectiveness of much government policy makes the cooperative solution a desirable alternative. Given the current deregulatory mood in the United States among policy makers (examples include: banking, airlines, and telecommunications), who have recognized the benefits of the market incentive approach, it would be practical to consider the applicability of cooperative management as an alternative approach to oyster fisheries management and fisheries regulation. If the individual waterman is involved in the stewardship of his own fishery, it becomes in the individual's own self-interest to place the collective needs first. Government would still hold an important place at the cooperative management table by recommending quotas and the length of the fishing season, since government for the most part, retains the scientific expertise. Also, it is this scientific expertise that can monitor the status of

disease within the oyster population and make appropriate recommendations.

The ecological and economic benefits from an efficiently run oyster fishery can be considerable. With the prospect of growing resource scarcity in the Chesapeake Bay oyster population and substantial social welfare gains to be realized from proper management, the viability of efficient, local cooperatives should be seriously considered.

Implications for Maryland's Future

If fishing communities have the authority to either prevent or restrict entry into fishing areas, the potential for controlling fishing is good. This is a particularly viable management option where the commercial species of interest is sessile, such as oysters. Highly mobile fisheries are not so amenable to this management strategy because territorial segregation is not as feasible. However, as has been tried elsewhere, self-managed quotas and gear restrictions can be feasible.

The notion of Individual Transferable Quotas (ITQ) as a means of assigning each fisher a share of the scientifically determined, total allowable catch is not new and there have been studies to measure its efficacy. ITQs, which can be traded or sold, give each fisher an economic stake in the recovery of a fishery, because their value increases as fish populations rebound ("A Major Step," 1997). Traditional fisheries management strategies have led to overbuilt fishing fleets, harvest limit over-runs and pressure to raise the limits/quotas. A fisher has no incentive to leave a finfish or shellfish in the water since someone else may catch it. Allocating ITQs gives fishers a stake in maintaining healthy fish stocks. However, fishers fear that ITQs could favor large corporations. ITQs can be designed to avoid giving large firms an advantage and they are being used successfully in three fisheries in the United States: halibut and sablefish, surfclams and ocean quahogs, and wreck fish.

One variation on the ITQ approach that has been proposed by Leal (1996) is a Limited Partnership Fishery. It is a cooperative management strategy that may be responsive to the needs of the Chesapeake Bay oyster fishery, a mixed gear, territorial fishery. Through the issuance of shares, comparable to shares in a publicly traded company, the partnership could establish perpetual rights to present and future income streams from the fishery. A study by Ralph Townsend (1995) provided the first real evidence that corporate management strategies could work as collective governance alternatives in fisheries. The oyster fishery could be defined by region (or county) and/or gear type, and the watermen would be permitted to purchase shares in the fishery. Out of each waterman's earnings from his catch would come a designated percentage of money that would go into a trust fund of sorts. The fund could be used as a source of annual dividend payouts to all shareholders and as a source of revenue for funding enforcement of regulations and quotas.

Once issued, shares could be easily traded among the watermen and could entitle the holder to certain harvest rights, or the right to use certain gear. In other words, a minimum number of shares would be required to be allowed a certain harvest limit (number of bushels) or to use a certain type of gear (such as patent tongs), or both. A management board consisting of watermen elected by fellow watermen in the fishery would need to be established. The board would set regulations, such as requirements for licensing, the maximum number of shares allowed per waterman, the gear allowed and their spatial separation on the fishing grounds. As in the corporate business world, part of the responsibility of this board of watermen, appointed by their peers, would be to ensure that the income-producing potential of the fishery is sustained over the long term. This is a particularly important point because in order for there to be sustained income, the oyster population itself and its habitat must also be conserved.

In a Limited Partnership Fishery, shareholders hold rights to a fishery's income potential

and thus have a personal stake in maintaining the future value of the fishery through conservation. As with any company, share value will rise or fall depending on the earning potential of the fishery, which is directly related to the biological condition of the oyster stocks and the efficiencies of the fishery. If the value of the fishery declines, so will share value. On the other hand, if fishing effort is temporarily curtailed to help rebuild future fish stocks, share values will rise over the long-term.

## Recommendations for Future Research

Any changes in the future will likely be the changing of the rules of management and harvesting for the public grounds. If oyster production is to be increased in the Chesapeake Bay, the cooperation, consent, and responsibility of the watermen are needed for any policy to be successfully implemented. This raises several questions that merit further investigation.

1. If financial support systems, such as the repletion program, are withdrawn, what other employment opportunities can be developed that do not disrupt the culture of the tidewater communities?

2. What other programs can be developed, such as the VIMS project that grows oysters above the sediment-laden bottoms, that utilize the native Eastern oyster, reduce losses from disease, and are cost effective and commercially viable?

3. What are the barriers to trust and cooperation between fisheries scientists/managers and watermen, and what is needed to bring down the barriers?

4. How would an understanding of the life histories of today's watermen and their families, and the impacts of regulations and the decline of the fishery on their lives, aid in formulating comprehensive management strategies?

5. How might economic models be developed that can measure and incorporate

nonmonetary benefits and the cost of habitat destruction?

The research questions posed above point in many directions and involve a wide spectrum of professional fields. The future of fisheries management will not and cannot be confined to fisheries biology and population counts. It will need to encompass a broad arena of disciplines working together toward a common goal.

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Yin, R. K., Bateman, P. G., & Moore, G. B. (1983, September). Case studies and organizational innovation: Strengthening the connection. Washington, DC: COSMOS Corporation.

# CURRICULUM VITAE

## Diana Locke

### Employment Experience

United States Environmental Protection Agency. August 1984-Present. May 1997-Present. Office of Pesticide Programs, Health Effects Division, Arlington, VA. Senior Toxicologist. Conduct risk assessments on pesticides regulated under the Federal Insecticide. Fungicide and Rodenticide Act (FIFRA) by integrating various findings from hazard and dose response assessments, and exposure assessments.

August 1984-May 1997. Office of Pollution Prevention and Toxics, Chemical Screening and Risk Assessment Division, Washington, DC. Senior Toxicologist. Senior technical and scientific expert on the hazard and risk assessment, and risk characterization, of industrial chemicals reviewed by the EPA primarily under the Toxic Substances Control Act (TSCA), but also sections 110 and 313 of the Superfund Amendments and Reauthorization Act (SARA), the Emergency Planning and Community Right-to-know Act (EPCRA) and the Resource Conservation and Recovery Act (RCRA).Office of Pollution Prevention and Toxics, Chemical Screening and Risk Assessment Division, Washington, DC

Naval Intelligence Support Center. August 1982-August 1984. Conventional Weapon Systems Division, Weapons Technology Department, Suitland, MD. Biologist/Microbiologist. Reviewed, analyzed and prepared summaries of foreign capabilities in toxin research for biological warfare use; their development, production, detection, protection and decontamination.

Smithsonian Institution, National Zoological Park. August 1979-August 1982. Office of Animal Health, Washington, DC. Research Physiologist. Designed and implemented pharmacokinetic research experiments to determine the effectiveness of a variety of antibiotics in birds and reptiles.

Walter Reed Army Institute of Research. August 1975-August 1978. Division of Experimental Surgery, Department of Gastroenterology, Washington, DC. Biological Research Assistant (Army Specialist-05). Member of a team of surgeons and research physiologists conducting physiological, immunological, and pharmacological research.

### Related Work and Experience

Canadian Wildlife Service. Summer 1973. Sackville, New Brunswick. Canada. Research Scientist. Conducted a study on the feeding habits of migrating ducks in a waterfowl refuge on the Tantramar Marsh, an estuarine wetlands on the New Brunswick/Nova Scotia border.

Fisheries Research Board. Summers of 1970 and 1971. Ellerslie, Prince Edward Island, Canada. Research Scientist. Designed and implemented a study on the effects of light duration and intensity, and substrate, on spat settlement of the Eastern oyster (*Crassostrea virginica*).

Education

High School Diploma. 1969. Westmount High School, Montreal, Quebec, Canada.

Bachelor of Science. 1973. Mount Allison University, Sackville, New Brunswick, Canada. Major in Biology with a minor in Chemistry.

Master of Science. 1975. University of Bridgeport, Bridgeport, CT. Biology-Education.

Connecticut and New York State Teacher's Certification. 1975. Biology and General Science at the secondary school level.

Doctor of Philosophy. 1998. Walden University, Minneapolis, MN. Administration/ Management.

Military Service

United States Army. August 1975-August 1978. Walter Reed Army Institute of Research, Washington, DC. Biological Research Assistant. Honorable discharge.

Teaching Experience

National Cathedral School. September 1974 - June 1975. Washington, DC. Teacher of Biology, Chemistry, and Elementary Physics, grades 4-6.

Westhill High School. Spring 1974. Stamford, CT. Student Teacher. Taught Human Physiology and College Preparatory Biology, grades 9-12.

Government Awards

Bronze Medals for Commendable Service. Awarded March 1987, March 1991, June 1994, and June 1996 by the Environmental Protection Agency in recognition for outstanding contributions to the Agency's mission.

Sustained Superior Performance Award. In recognition of high quality performance, awarded annually November 1987-1997.

Letters of Commendation. Letters of Appreciation and Special Achievement Awards.

Publications

Harmon, J. W., Locke, D., Aliapoulios, M. A., & MacIndoe, J. H. (1976). Interference with testicular development by tetrahydro-cannabinol. Surgical Forum, 27, 350-352.

Zinner, M. J., Wickline, D. L., Locke, D., & Gurll, N. J. (1977). The effect of endotoxic shock and fluid expansion on regional blood flow in the baboon. The Physiologist, 19, 339.

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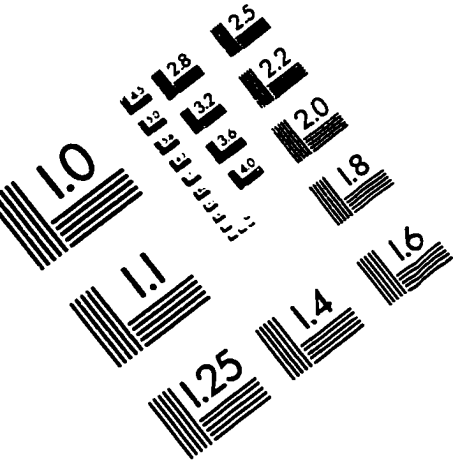
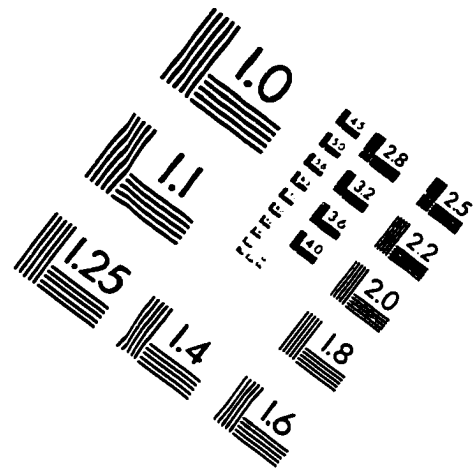
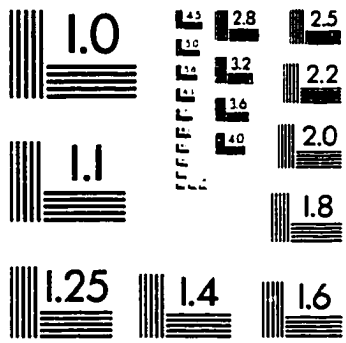
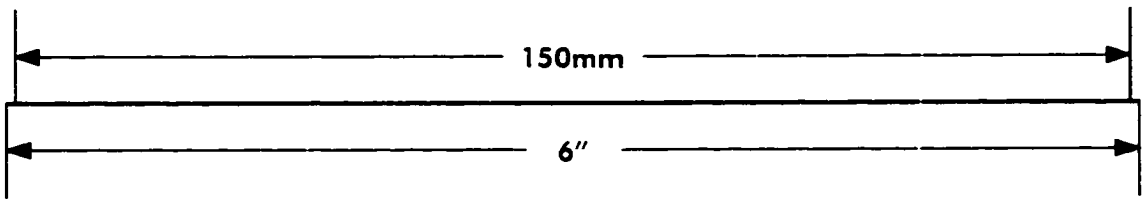
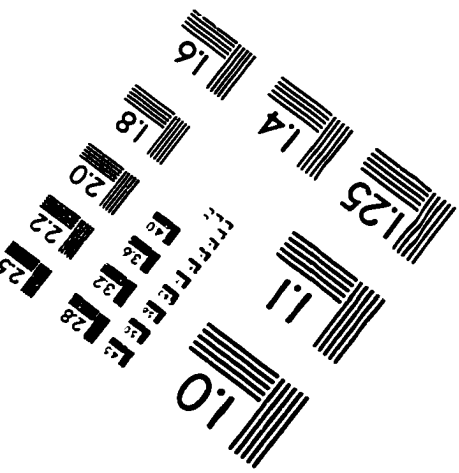
# IMAGE EVALUATION
# TEST TARGET (QA-3)

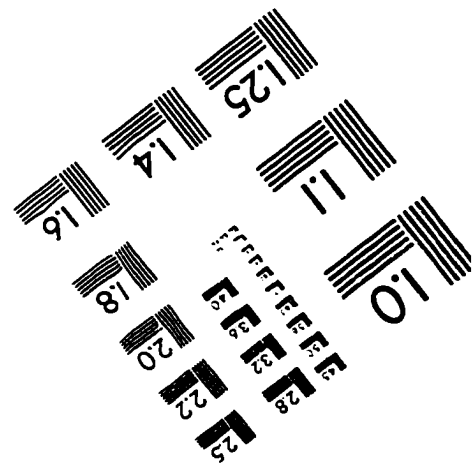
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