

Common Property Rights in Fish and Water Quality:
The Oyster Fishery of the Chesapeake Bay

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Paper prepared for presentation at the meeting of the International Association for the Study of Common Property, Duke University, Durham, NC, September 1990.

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INTRODUCTION

Since the 1950's, economists have recognized that the structure of property rights effects the way people use a natural resource (Coase 1960; Gordon 1954; Scott 1955). Subsequently, economists have expanded the study of particular property rights systems to how property rights systems change over time (Anderson and Hill 1976; Dahlman 1980; Davis and North 1971; Demsetz 1967; Runge 1985; Ruttan 1984; Schmid 1987). One perspective is offered by the New Resource Economics (NRE) literature (T. Anderson 1982). From the NRE perspective, change results when entrepreneurs identify alternative property rights arrangements which can enhance the potential economic value of resources. These entrepreneurs then enter the political arena to bring about changes necessary to realize those economic values (T. Anderson 1982; Anderson and Hill 1976; Gardner 1985; Seagraves 1973). In accord with the neoclassical economic decision model of individual choice, agents of change take political action based upon a marginal analysis of their benefits and cost. Included in their cost calculus are the transactions cost of bringing about change.

The NRE argument also suggests economically rational change agents replace 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" (Anderson and Hill 1976, p. 938). To support this argument, a literature in economic history has developed which traces the evolution of property rights from open access to private ownership and explains these events as the consequences of moves to attain economic efficiency (Anderson and Hill 1976; Dahlman 1980; Davis and North 1971).

However, another group of economists offers an alternative perspective on property rights changes (Batie 1984; Bromley 1982, 1986; Norgaard 1984; Runge 1985; Schmid 1987; Shabman 1985), a perspective which considers more than opportunities for efficiency gains. For them, the distribution of economic benefits, social values, environmental conditions and non-economic sources of political power must also be considered.

For many years economic studies have reported that greater financial returns are made on private oyster beds than on the public commons (see for example, Agnello and Donnelley 1975, 1976; Alford 1975; Christy 1964; Power 1970; Quitmeyer 1955). Given the apparently greater financial return from a private property rights structure, it follows, from the NRE perspective, that if

privatization did not occur it was because the transactions costs of achieving private property exceed the economic benefits to be captured. Yet, this argument is too simple because there is some private property in the oyster grounds of the Chesapeake. In fact, both common and private property exist side by side in the Bay. Further, the property rights structures in Virginia are very different from those found in Maryland. Why, with respect to the oyster grounds of the Chesapeake Bay, do we have a) the co-existence of common and private property, and b) two states with very different property rights structures to the same resource? Can the transactions costs of privatization be so different from one acre of oyster bottom to the next, or between oyster bottom in one state and in the other as to explain the failure to privatize all the oyster bottoms? In fact, transactions costs alone cannot explain the patchwork pattern of property rights to the oyster grounds. Instead, we believe that the property rights system in the Bay is the result of a complexity of factors that can best be explained by a more detailed historical perspective which includes a broad conception of the social values and concerns that have been associated with this fishery.

The implications for the role of the social scientist in the policy making process derived from each of these perspectives also differ. From the NRE perspective, the role of economists and other social scientists is to design and promote policy reforms which encourage movement towards private property rights to natural resources, often by finding ways of reducing transaction costs. Those less enamored with the NRE argument presume no superiority of private property rights. Further, they are more careful to draw a distinction between "open access", in which access to a resource is truly unrestrained and common property where access is limited to members of a specified group. (Ciriacy-Wantrup and Bishop 1976). Common property is the case where ownership of the resource is held by a group and rules for access to or use of the resource are established by the group. Private property is the case where a single economic agent is granted discretion over all resource exploitation decisions.

This paper presents a case history of the evolution of the property rights structure to the Chesapeake Bay oyster grounds. The first objective is to explain the reasons for the creation and persistence of this mixed property rights system during the past 100 years. The second objective is to evaluate these two alternative perspectives in terms of their ability to explain the evolution of property rights to the Chesapeake Bay oyster grounds. The final objective is to draw implications from this history for the role of the social scientist in research and policy advising on oyster fishery management. Before discussing the history of the current property rights system, we provide a brief discussion of oyster biology and a more detailed description of the current property rights system.

THE OYSTER FISHERY OF THE CHESAPEAKE BAY

Salinity Influences Growth and Mortality

Oysters spawn by releasing sperm and eggs into the water column where fertilization occurs. Populations of adult spawning oysters are called a brood stock. Oysters are in a larval stage for the first two to four weeks of life, during which time they float freely in the water. At the end of this period, the oyster develops a "foot," settles to the bottom and attaches itself to some hard, clean surface of substrate. Old oyster shells tend to collect many of the newly settled oysters, then known as spat. Once it has cemented itself to a surface, the oyster is unable to move again. It feeds by filtering microorganisms from passing water growing to a small "seed" size and then to a market size of three inches in about three years. They grow fastest in the more saline waters of the Virginia portion of the Bay (Haven et al. 1981). Historically, the bottoms where this setting process had been most successful were identified as "natural" bottoms. If the bottom is muddy, or silted over, the larvae fail to set. These bottoms were historically termed "barren" bottoms.

Unfortunately, the Chesapeake Bay is now host to salinity dependent oyster pathogens which have had serious effects on oyster production in the most recent years of regional drought (Bosch and Shabman 1990b). The pathogens causing the heaviest mortality rates among Chesapeake Bay oysters are MSX (*Minichinia nelsoni*) and Dermo (*Dermocystidium marinum*). MSX, which appeared in the Chesapeake Bay in 1960, is the most devastating of the diseases. While research on the disease has been emphasized there has been little progress on understanding the life cycle of the pathogen or on finding a resistant strain of oyster (Bosch and Shabman 1990a) The only factor that allows for management planning is a strong positive correlation that has been discovered between salinity levels and the prevalence of the disease.

Prevalence of Private Cultivation in Virginia

By delimiting boundaries to sub-aqueous ground, property rights to an oyster bed can be defined since adult oysters cannot move. Only Virginia has encouraged the long-term leasing of private property rights for the artificial cultivation of oysters. Leaseholders in Maryland are subject to limitations on acreage and harvest gear use not imposed on planters in Virginia. In Maryland private grounds production has always been at less than five percent of total state harvest while in Virginia private grounds harvest has been as much as ninety percent of total harvest.

Since all the grounds where oysters set best are included in the public grounds, only the barren, usually soft muddy bottoms are available for lease. This means that the leaseholder must

invest in the establishment of a hard substrate to prevent the silting over of the crop and usually must purchase seed oysters to plant on his ground. However, since the owner can control the population density, the production rates on private leaseholds can exceed that on the natural grounds. Private planters in Virginia can harvest in any season they choose and may use power craft to dredge their oyster beds. The dredge is a metal frame with teeth along its lower edge and a bag behind to catch oysters as it is pulled across the beds. With a dredge, a waterman can harvest five times as many oyster in a day than he could with hand tongs. Private oyster grounds managers are aquacultural entrepreneurs, always seeking ways to increase the financial returns they earn from their leased beds.

Until 1977, most of Virginia's oysters were harvested from private grounds. The productivity of the leased grounds was more adversely impacted by the spread of MSX than the productivity of the public grounds because leases are primarily held for the more shallow and saline waters where MSX thrives. Following this biological effect on production, prices for market oysters relative to private production costs fell and this price-costs squeeze has further discouraged production (Shabman and Bosch 1990b).

Current Public Grounds Management Policies

Surveys of the Bay's bottoms were made in Virginia and Maryland around the turn of the century to identify the naturally occurring beds and thereby define the public grounds. Access to these grounds is managed by the state. Harvesting is subject to limitations on season, gear and daily hours in both states. Watermen (as Bay fishermen are locally referred to) are restricted to the use of hand tongs on most parts of the commons. These are scissors-like devices consisting of two long poles with a toothed rake at the end of each. They originated with the Indians and their design has remained unchanged for over one hundred years. The waterman works the bottom from the side of his boat by opening and closing the tongs until he feels that enough material has gathered in the basket formed when the poles are pushed together. The tongs are then raised to the deck. The load is culled for market size oysters, and remaining material is returned to the water.

In the deeper waters of Virginia, watermen are permitted to use patent tongs which are lowered and raised mechanically. In Maryland, skipjacks, sail powered craft, have traditionally been permitted to dredge along specific portions of the public bottoms. Since 1979, dredging for oysters with motorized boats has been permitted in some areas of Virginia's public grounds.

The public grounds in each state could accurately be described as "state oyster farms". The state manages the public grounds much as private planters in Virginia manage their beds. In

the oyster shell repletion programs, oyster shell is collected from processors and mined from large deposits of old, buried shell and then planted on the public grounds. The availability of this additional material, called cultch, for the larvae to attach to increases the number which are likely to set and mature to market size. In Maryland, an annual average of 6 million bushels of shell is planted on the public grounds. In Virginia, the annual plantings have varied from year to year, generally falling in the range of 500,000 to 1.5 million bushels per year.

Some parts of the Bay receive large, natural settings of larvae. This however causes overcrowding and slows the growth of the oysters. As a result both states hire watermen to harvest the seed which are then transplanted to areas better suited for rapid oyster growth. Also, in Virginia the seed harvesters may sell seed to private planters. Both states place shell in seed producing areas to enhance setting rates and seed production. In addition some Virginia planters have developed their own seed beds by placing shell on the barren grounds available for lease. However, most private growers must compete with the states' management programs for shell and seed.

EMERGENCE OF PROPERTY RIGHTS TO THE OYSTER GROUNDS

The current property rights structure to the Bay's oyster grounds was fully developed by 1910. By then the differences between the two states in terms of private leasing and management of public grounds were evident. Since that time oyster policy in both states has been primarily directed toward management strategies to be used on the public grounds. In the evolution of these property rights structures, the public grounds harvesters in Maryland have been more successful than their Virginia counterparts in restricting private leasing and in obtaining support for public grounds management. In this section we identify reasons why.

Before the Civil War, the oyster grounds of the Chesapeake Bay were an open access resource. Although legislation regulating the taking of oysters had been enacted, no attempt had been made to enforce the laws. The first harbingers of change to appear on the horizon were dredging vessels from New England and New York. Having exhausted the natural grounds in their own states, the Northerners turned their efforts to the oyster of the Chesapeake Bay.

At the time there was little demand for exclusive harvest rights to the natural bars by either local watermen, seafood processors or northerners because the natural supply was so plentiful. Cultivation of natural bars was not worthwhile because the oysters were already so densely populated. Some processors and dealers expropriated grounds in the tributary rivers simply to store oysters when the buying price was low in order to sell when price was higher (Ingersoll 1882; Stevenson 1892; Wharton 1948).

In the 1880's, oyster harvests reached historically high levels of about 12 million pounds annually, as grounds covered with previously untouched stocks of mature oysters were dredged and tonged. This unrestricted harvesting of the 1880's eventually began to deplete the stocks of mature oysters found on the newly discovered bars. More importantly, this oyster rush also destroyed the productivity of the natural oyster bars, as no effort was made to replace shell stock. Indeed, it was during this period, that two individuals, Lt. Francis Winslow, USN and William Brooks, Professor of Biology at Johns Hopkins University (Brooks 1891; Winslow 1881) explained how the failure to replace the shell stock was destroying the natural oyster bars. Further, they demonstrated that oysters could be cultivated through the transplanting of seed onto less densely populated grounds. The time to assess property alternatives to open access had arrived by the late 1880's.

The insights of Winslow and Brooks into oyster cultivation were widely disseminated, giving them prominence in the public debate. They were leading advocates for the privatization of the oyster grounds at the end of the nineteenth century (Brooks 1891; Winslow 1894). Brooks wrote extensively of the success of oyster farming in France and chastised those who raided the few private beds being cultivated in Maryland at the time. He put forward the question (Brooks 1891):

How can the people of the State be brought to perceive that private enterprise in oyster culture is to their advantage, and what can be done to develop a sentiment of respect for private property in oysters? (p. 142.)

Armed with these newfound principles of scientific management, on shore oyster processors began to lobby for legislation to permit leasing of exclusive rights to areas of the Bay bottoms so that the gains from scientific cultivation of oysters would accrue to the private property owner. However, despite the potential financial gains from the encouragement of private cultivation through leasing, the hand tonging watermen of Maryland and Virginia opposed leasing of the bottoms and were able to exercise substantial opposition in the two states' legislatures (Winslow 1894).

These watermen feared that they would not be the recipients of the leases, that private production would depress the price significantly enough to harm their incomes and that the lease holders would be a concentrated group of processors who would exercise monopsony power in the buying of oysters for processing (Stevenson 1892; Winslow 1894). They feared that the net result would be a loss of their opportunity to be self-employed watermen, a job in which they enjoyed certain non-monetary returns that in current times are referred to as worker satisfaction bonus (L. Anderson 1980.)

All these fears, without regard to their validity, suggest that the tonging watermen were concerned that privatization would redistribute their perceived natural rights to employment and income in the fishery to a wealthy class of planters. For these watermen, the open access fishery was an entitlement, if not a right defined in law. The watermen were a poor class of whites and former slaves. They had no interest in becoming farmers, whether of the land or of the sea. At the Convention Called to Consider and Discuss the Oyster Question held in Richmond in 1894, Lt. Winslow described the attitudes and beliefs of the tongers stating that, "They have been accustomed to work at will and with entire freedom. They are suspicious of any attempt at improvement of other areas. They strongly apprehend a scheme to deprive them of a privilege so long enjoyed as to have become, in their minds, an inalienable right." In both states, the tongers earnestly believed that wealthy, outside corporate interests would gain control of all grounds made available for lease (Stevenson 1892; Wharton 1948).

The hand tongers were successful in restricting the leasing of sub-aqueous grounds for the private cultivation of oysters for a number of reasons. First, the watermen were considered an underclass and their possible displacement by expanding private leaseholds was considered to be detrimental to the economies of the regions around the Bay. In effect, the maintenance of the fishery as an employment source for this class of people was seen as an "employment insurance" program, assuring that the watermen were not displaced to become a burden on the rest of society. Stevenson (1892) noted that the economic stability of the region depended upon the wide distribution of the benefits provided by the preservation of public grounds. Any change in policy adversely affecting the income earning opportunities of the tongers would send shock waves throughout the economic structure.

Second, in Maryland, the potential lease holders were not a favored class. Since cultivation of oysters requires an initial investment in grounds preparation and allows the use of more capital intensive harvest techniques, there was reason to expect that the leaseholds would be taken up by the processors who had access to investment funds. These processors tended to be recent decedents of the New England dredgers. Thus those who favored leasing were perceived of as "outsiders," especially in Maryland.

Third, in both states the concerns of the fishery were only of interest to those who resided near the Bay. The legislative representatives of those regions were responsive to the voting numbers of the watermen who opposed leasing. These legislators were the ones who took leadership in the legislature for development of a property rights system the watermen would accept (Alford 1975; McDonald 1880).

If the grounds reserved from private leasing were to remain productive, however, the work of Brooks and Winslow made clear that open access was not tenable. Harvest effort would need to be controlled to protect the oyster brood stocks and the quality of the grounds. Both Virginia and Maryland officials believed that the destructiveness of the natural bars with the use of dredge technology was a significant reason for the decline in the fishery. Restricting harvest on public access beds to the labor intensive hand tong was perceived as a good means to protect the bars, and to accommodate other social objectives, like economic stability. The watermen themselves were anxious to limit harvest to hand tongs because the labor intensive nature of the technology assured their group of employment opportunities.

Additionally, the dredgers were disliked because the dredging industry had come to be identified as an "outlaw" industry. Laborers on dredge vessels came from an entirely different class than the tongers. At first, many were local blacks, however, after a few seasons of this work they refused to sign on anymore. The work required no skills and involved extreme exposure to the elements. It was shunned by most all Bay residents. None but the most destitute could be induced to work a dredge vessel. At times it was necessary to resort to measures that strongly resemble impressment and violence to secure labor. Drunks and unsuspecting immigrants were often shanghaied into service by labor contractors. Immigrants without family or friends were in danger of being "paid off at the boom," i.e. being thrown over board, by murderous captains (Stevenson 1892).

For all these reasons, legislators did not find it difficult to limit the use of dredges on the public grounds. In Maryland, the authority to regulate harvesting of public and private grounds in shallow, coastal waters was assigned to the counties, resulting in a patchwork of rules, which often restricted effort to tonging by county residents. The deeper waters of the main stem of the Bay, under the authority of the state and not suitable for tonging, were opened up to dredging, but only under sail power. This remains the case to this day (Power 1970). In Virginia, dredging was prohibited on public grounds, although some minor exceptions were made in the 1970's.

However, the forces opposed to and in favor of private leasing were not the same in the two states. The pressures for granting private leasing were stronger in Virginia than in Maryland because the high salinity of the Virginia waters promised higher returns for private cultivation. There were two reasons for the higher rate of return in Virginia. One is that oysters in high saline waters grow more quickly. Two, Virginia oysters commanded a higher price because Northern consumers, used 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 lease holders were more active in the legislative process in Virginia (Winslow 1894) .

In Virginia a compromise was reached in reforms of the oysters laws in 1892. The state 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 Lt. Baylor, USN, and these public grounds came to be known as the Baylor grounds.

Private leasing in Virginia was not quite as much a threat to the watermen as it would have been in Maryland. One reason is that the expansion of private planting created a market for seed harvested by hand tonging watermen. This was because the source of seed is the James River of Virginia where the seed beds are reserved as public grounds. To this day, watermen along the James jealously guard their perceived entitlement to the James River seed. Second, 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 ground. Third, many private planters had their grounds harvested by hand tong because, if dredged the substrate in which they has invested would become silted over. Tonging minimized the disturbance of the bottom. As a result, tongers' opposition to leasing was muted in Virginia by the employment opportunities created by private planters on both public and private grounds. Leasing grew rapidly in Virginia and by 1902 production from the private grounds exceeded the harvest from the public grounds. This remained true until the late 1970's.

Maryland's watermen were strongly opposed in principle to leasing of either natural or barren bottoms. However, with its lower salinity levels, expected returns from private planting were not as large. Though private leasing of barren ground was eventually provided for in the Haman Act of 1906, this law also included many provisions which inhibited private cultivation. It required that no seed be sold to private planters until a substantial amount had been placed on public grounds. This forced private planters to import their seed from Virginia, thereby raising their costs and subjecting them to uncertainties in supply, since Virginia would oftentimes restrict the export of seed to protect its own planters. The Act limited leases to five acres and prohibited dredging. The thin profit margins were further eroded by raids made on private grounds by tongers, against which the state took little action. Even if caught and brought to court, juries of their peers were not likely to convict raiding watermen.

Perhaps the greatest disincentive to private planting was the clause that permitted legal challenges to the lease. While a survey had also been done of Maryland's grounds to identify the naturally producing areas, if three witnesses could be found to testify that

they had harvested any number of oysters from the private ground within the preceding five years, the ground would be ineligible for lease and reclassified as public grounds, though compensation would be paid for any oysters already planted. The Maryland watermen have consistently used this power to prevent the development of private leasing in their state (Power 1970.)

This history suggests that the Maryland watermen were more powerful in influencing the evolution of the property rights structure than the traditional Virginia watermen. This possibly stems from the higher accord granted to the industry by the policy making structures in Maryland when compared with Virginia. It is this "power" held by the Maryland watermen that must be factored into an understanding of the fishery.

An excellent illustration of the relative influence of oyster harvesters in the two states is the water quality management decisions which were made shortly after the rights systems for the oyster grounds were developed.

The development of the germ theory of disease in the 1890's had a profound effect on public health policy. With the correlation between sewage and disease in urban environments now explained, cities were willing to invest more in sewage disposal systems to remove waste water (Burke 1985). In the cities around the Bay, the Bay itself seemed to be a logical, cheap dumping ground for the untreated sewage from the new systems. Rather than treat the sewage, the cities would make use of the Bay's natural assimilative capacity. Germ theory also led scientists to trace cases of typhoid and other infectious diseases back to the consumption of oysters contaminated by waste from sewage disposal. To protect the public image of the oyster industry as well as the public health, public health officials in Maryland and Virginia were authorized to close polluted grounds to harvesting. Thus was set up the conflict between the use of Bay waters for disposal of untreated sewage and for oyster production.

Baltimore had been considering the construction of a municipal sewage system since the appointment of a study commission in 1893. The first report of this commission issued in 1897, recommended the discharge of untreated wastes into the Bay. The oyster industry, both packers and watermen, brought sufficient pressure to bear on city officials that the proposal was rejected. In 1904, the city asked the Maryland General Assembly for authorization to form a sewer authority and issue bonds for the construction of a system. The oyster interests had their representatives in the General Assembly include a provision which prevented the commission from constructing any system involving the discharge of sewage into the Chesapeake Bay or any of its tributaries. Since literal interpretation of this would make the task impossible, the commission decided that it would allow for discharge of water treated so that it was of the "highest

practicable degree of purity" (Capper, Power and Shivers 1983:89). The commission adopted a plan to build what was to be the largest undertaking of sewage purification in the country. Baltimore spent an enormous amount of money to treat its waste for the primary purpose of protecting the oyster beds from contamination. This was necessary to overcome the resistance of the oyster interests in the state.

The story in Virginia is quite different. At first, the Board of Fisheries reacted by trying to discount the public panic over contaminated oysters. It referred to those concerned about the effect of contaminated oysters on public health as "pure food faddists" and the whole movement to close polluted grounds as part of the "pure food craze" (Capper, Power and Shivers 1983; Wharton 1948, 1949). By 1914, the Board recognized the seriousness of public concern over polluted seafood and its adverse effect on demand for the product. In its annual report that year it called for the construction of sewage disposal plants, as had been installed in Maryland. While sewage systems were being built in tidewater communities, they were for the purpose of removing sewage from the city limits. Sewage continued to be dumped, untreated into streams and bays. Despite the damage done to the oyster beds, neither the state legislature nor the courts were willing to impose restrictions on this practice. Though the value of many of the private beds was destroyed by this nuisance, leaseholders could not get injunctions against the polluting municipalities. In cases brought by private planters, the courts held the rights of the cities to use the Bay for sewage disposal as superior to the rights granted to them in leases from the state (*City of Hampton v. Watson* 119 Va. 95, 89 SE 81 (1916), *Darling v. City of Newport News* 123 Va. 95, 96 SE 307 (1918)). In Virginia, the Bay was valued more for its ability to take away sewage than for its production of oysters.

Protection of the interest of harvesters of both public and private grounds in water quality was brought to court in 1932. The Attorney General brought suit against Newport News (*Commonwealth v. City of Newport News* 159 Va. 521, 164 Southeastern Reporter 589 (1932)) when the City announced plans to build a new sewage system but without any treatment works. The Attorney General sought an injunction against the city's construction of the proposed system and a decree prohibiting the city from dumping wastes unless it installed a chemical treatment plant so as to render the discharge innocuous.

As in the earlier cases, the court found that the use of the waters of the Bay for the discharge of sewage is a public interest, while the oyster fishery, both public and private grounds, is a private use of a public resource, and that the public interest takes precedence, remanding the problem of how to manage the water to the legislature. Only in 1946 was the State Water Control Board established with the responsibility for the pollution control

throughout the state and only in much more recent times has this pollution control responsibility been exercised fully. Meanwhile nearly one-half of the states oyster producing waters have been closed to oyster harvest (Haven et al. 1981).

Today water quality management is a major environmental program in both states. However, the potential benefits for oyster harvesters in the Bay, come less from their own efforts than from the efforts other interest groups, e.g. recreationists, environmentalists, resort owners. The oyster industry is now a "free rider" on the political resources others devote to water quality improvement, yet restoring the oyster fishery has taken on a symbolic value as a measure of success of the Bay restoration program. Hence, management of the oyster fishery remains a priority even as its relative economic importance has declined. In this context the watermen and their desires will continue to exert significant influence on design of the management program.

EVALUATION OF THE ALTERNATIVE PERSPECTIVES

Seeing this mixed property rights systems, economic studies of the Chesapeake Bay oyster fishery have, for decades, advocated privatization of the commons, as cited above. Basic textbooks in natural resource economics now use the public oyster beds of the Chesapeake as a prime example of the economic inefficiency of all common property resources (Howe 1979; Tietenberg 1988). All these economic studies purport to demonstrate that there is too much labor and too many boats in the fishery - labor and capital which could be more efficiently employed elsewhere in the economy. Indeed, 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).

Despite 100 years of prodding by biologists and economists to privatize all the bottoms, watermen, policy makers and the general public have not accepted their advice. Instead, in the past two decades both states developed new initiatives to increase oyster production on common grounds. In Maryland during the 1970s the state 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. In Virginia in the mid 1980s seed transplanting between public grounds was increased and regulatory actions permitted harvest of small oysters from public grounds in the James River (Virginia. Marine Resources Commission Reports). These decisions in Virginia reduced seed availability and raised seed cost for Virginia's private oyster planters in the long run interest of promoting public grounds production.

Policy for management of the oyster grounds has been formed by the respective state legislatures, 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 Bayside communities. The other objective was to increase production, and in Virginia this meant promoting private cultivation. The result has been a mix of public grounds where access is restricted by regulations on gear and effort and investment in productivity enhancing activities has been under the control of the state fishery management agencies. Leaseholders are free to adopt any practices that maximize their financial returns. The evolution of property rights to the oyster grounds has not proceeded to the end of complete private property both predicted and advocated by the NRE perspective.

Establishing a private property rights structure for all oyster grounds would have had two effects on labor: (1) capital, in the form of dredges and patent tongs would be substituted for labor, thus reducing labor employment in the fishery; if total harvest rose substantially some of the displaced watermen might be returned to the fishery on a wage hire basis; and (2) the character of the work experience and "job qualifications" for being a waterman would be altered from that of a risk taking harvester of the wild stock to that of a production manager or employee of an aquacultural enterprise.

The NRE perspective fails to explain the evolution of property rights to the oyster grounds of the Chesapeake Bay because the argument considers only the financial returns from substituting capital for labor. Economists studying the fishery have failed to include both the non-monetary values that the watermen derive from the work itself and the quality of life afforded by preserving opportunities to reside in the traditional fishing villages as opportunity costs of adopting what they, as outside observers, 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 welfare loss by being denied the lifestyle of "working on the water." Owning his boat and gear gives the waterman a sense of independence not available in the alternative employments. Evidence of the existence of these non-monetary values can be inferred from the opposition of the watermen to privatization.

A survey of Virginia's oyster harvesters in 1985 found that 88 percent of them had lived in their current communities for over twenty years (Santopietro 1986). Most watermen live in small, distinctive villages along the many necks and tributaries of the Bay. Many of them own houses bordering on the water, so that they are near the grounds they harvest and are able to return home each evening. These communities are characterized by tight-knit kinship interactions (Bundy and Williams 1978.) Because of limited in-migration, the residents for the most part are descendants of colonial era settlers. Those living in the relatively isolated

fishing communities of the Eastern shore and the Bay islands tend to speak with a unique accent that is believed to be close to the English spoken in colonial times. This makes it difficult for them to move away from the region. The lack of alternative employment opportunities in the local communities means that denying access to the public grounds is tantamount to denying individuals the right to live in their home communities. The preservation of the communities has historically depended upon the distribution of income afforded by the common property institutions.

The history of the fishery and the persistence of the property rights systems demonstrate that watermen prefer to compete against one another according to the rules and regulation necessary for the management of a commons. With this arrangement, all benefits from the oyster fishery flow to the 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 shallower coastal waters has served to maintain these communities. A change in the property rights structure of the Bay's oyster fishery would involve a change in harvest technology, and a change in the distribution of income that could threaten the existence of Bayside communities. Only with this broader perspective of the rights system is it possible to understand the history of the fishery and avoid making useless policy recommendations for the future.

IMPLICATIONS

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, their circulation patterns, the mild climate and the shallowness of the Bay create conditions under which oysters have flourished. For over one hundred years, the Chesapeake Bay was the nation's primary supplier of oysters. However, by 1976 the Bay region has fallen to second place in market share to the Gulf states (National Fishery Statistics Program 1984).

Disease, labor availability and seed costs are the fundamental issues facing the fishery today. The combination of disease associated with droughts of the last few years and rapidly rising price of seed has not only radically reduced the profitability of private planting but also threatens to disrupt the newly initiated state efforts to engage in seed transplanting (Bosch and Shabman 1990a,b). Meanwhile, those watermen who remain in the public fishery are not as committed to maintaining a hand tong fishery, but do increasingly favor permission for dredging of natural grounds which are replated by the state with transplanted seed (Santopietro 1986). In fact this is a reflection of the lack of new recruitment of hand tongers because of changing economic opportunities in the region and low income earning potential. At

the same time the watermen still violently oppose leasing public grounds (Santopietro 1986).

As the states look ahead to revitalizing their oyster fisheries the calls for privatization of common grounds are being made again (Leffler 1986). However, the history of the oyster fishery suggests that any change in property rights will not be toward increased privatization, but rather will be toward changed rules of management and harvest for the common grounds. Knowledge of this history on the part of natural and social scientists will encourage research activities that focus not on advocating privatization, but rather on defining optimum management programs for the commons. For the Chesapeake Bay oyster fishery this means designing strategies and policies for improving placement of shell, increasing seed production, regulating dredging on public grounds and minimizing the damage from MSX (Bosch and Shabman 1990a,b; Shabman and Thunberg 1988). All these are intended for a fishery that will continue to have both private and public grounds. The effectiveness of economists and other advisors in the fishery policy process will be much enhanced by an accurate understanding of this history and its influence on people today.

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