

THE HIGH MODERNIST MOMENT: OYSTERS, KNOWLEDGE PRODUCTION,
AND CONSERVATION IN THE PROGRESSIVE ERA, 1878-1917

by

SAMUEL PARIS HANES

A Dissertation submitted to the
Graduate School-New Brunswick
Rutgers, The State University of New Jersey
in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Geography

written under the direction of

Dr. Bonnie J. McCay

and approved by

New Brunswick, New Jersey

October 2008

ABSTRACT OF THE DISSERTATION

The High Modernist Moment: Oysters, Knowledge Production, and Conservation in the
Progressive Era, 1878-1917

By SAMUEL PARIS HANES

Dissertation Director:
Bonnie J. McCay

Oysters had a long history on the U.S. east coast of local-level management and this dissertation explores the transition to from local to state oysters management between 1880 and 1920. To do so, it uses James C. Scott's description of "high modernism." Scott defines high modernism as visionary state planning with sweeping restructuring that simplify natural and social systems in an effort to make them more legible for greater control. According to Scott, simplification leads to unintended consequences and failure because it undermines social and environmental complexity. In marine fisheries, high modernism takes the form of privatization and aquaculture. Oysters were the largest U.S. fishery in the late 1800s and they were the first case where U.S. government officials and scientists tried to privatize a marine fishery. Government aquaculture experiments were meant to aid the privatization effort. This study explores what led to this form of high modernism in marine fisheries management. In addition, the dissertation examines how these radical reform efforts failed due to resistance from oystermen and environmental difficulties with aquaculture. The dissertation argue that instead of high modernist reform, the new state agencies rationalized older management practices, which formed the basis for state-level management. The older oyster management system grew out of

conflicts over oysters and contained a complex mix of practices and property rights, many of which were poorly or ambivalently upheld. The new state management agencies rationalized these older practices, and this required making them more bureaucratic. Much of the early efforts of the state agencies were directed toward producing knowledge for this end.

Acknowledgements and dedication

I would like to thank my dissertation committee, Thomas K. Rudel, David M. Hughes, Kevin St. Martin, and Phaedra Daipha, for their insightful comments, and particularly my primary advisor, Bonnie J. McCay, who read multiple drafts. Her generous intellectual guidance has been challenging and thought-provoking throughout.

I am grateful for the time and effort of the archivists and librarians at the locations where I conducted research. Archivists at the National Archives deserve special mention, as do persons at University of Maryland's special collections, University of Virginia's special collections, Rutgers University's special collections, University of Rhode Island's special collections, the Maryland State Library, Maryland Law Library, Connecticut State Library, and the Library of Congress.

The Human Ecology Department at Rutgers provided a research travel grant at a crucial time, and I would also like to thank them for providing teach opportunities that allowed me discuss my research with undergraduates and that helped offset some of the research cost. Rutgers Geography Department and Writing Program also provided teaching opportunities, and the Geography Department awarded a fellowship, all of which helped to make the dissertation possible.

Lastly, I would like to thank the many persons who have given me feedback on this project, especially my fellow graduate students here at Rutgers. My wife, Teresa Johnson's, knowledge of fisheries management made the dissertation more realistic, and our discussions of the theoretical aspects of this project have been my source of inspiration, and so I dedicate this dissertation to her.

Table of contents

Abstract.....	ii
Acknowledgements and dedication.....	iv
Table of contents.....	v
List of illustrations.....	vi
Chapter one: introduction.....	1
Chapter two: oyster management before 1880.....	28
Chapter three: law enforcement and licensing.....	65
Chapter four: commissioners as legislative advisors.....	97
Chapter five: natural science.....	151
Chapter six: mapping planter's property.....	212
Chapter seven: mapping natural beds.....	239
Chapter eight: sanitation science.....	277
Chapter nine: conclusion.....	296
Illustrations.....	307
Works cited.....	315
Curriculum Vita.....	325

List of illustration

Figure 2.1: Oyster tongs.....	307
Figure 2.2: Tongers in Prince’s Bay, Staten Island, New York.....	308
Figure 2.3: Oyster dredge.....	308
Figure 2.4: Planting boat.....	309
Figure 4.1: Large planting steamer, the <i>Henry C. Rowe</i>	309
Figure 5.1: Lake Fusaro.....	310
Figure 5.2: Rutgers University’s shellfish laboratory, the houseboat <i>Cynthia</i>	310
Figure 6.1: Connecticut lease map.....	311
Figure 7.1: Half of H. F. Moore’s James River resurvey map.....	312
Figure 7.2: Detail of Moore’s map showing oysters and Baylor lines.....	312
Figure 7.3: Half of an Apalachicola Bay, Florida barren bottom map.....	313
Figure 7.4: Detail of the Apalachicola Bay map.....	313
Figure 8.1: Fuller’s Narragansett Bay sewage map.....	314

Chapter one: introduction

1.1 Introduction: oysters in the Progressive Era

Oysters grew to be America's largest fishery in the late nineteenth century, as growing populations, coastal railroad connections, and improved canning methods all increased demand. The fishery's center was on the east coast, from Cape Cod through the Chesapeake Bay. In this region the oyster fishery had a long history of local level management. It involved public property for oyster beds and leases for "planting grounds," where oystermen grew oysters in an aquaculture system. However, by 1880 local depletions and fear of over-harvesting led state governments to form agencies to manage this contentious fishery. These new agencies began producing knowledge to understand and manage the fishery.

This dissertation explores the advent of state-based resource management with regards to the oyster fishery. It explores the complex relationship between local people in the oyster fishery and the knowledge production of the new scientists and officials. It also explores the role of the new system of knowledge production in the larger processes of modernizing natural resource management that took place during this period, which is known by historians as the Progressive Era. The Progressive Era conservation agencies were part of a larger movement shifting the locus of dealing with problems from the town level to more centralized entities, be they state governments or corporations. In U.S. conservation, these new agencies practiced what Hays calls "the gospel of efficiency," in which they tried to eliminate waste and increase efficiency through the application of objective science to resource management problems.¹

¹ Hays, Samuel. 1959. *Conservation and the gospel of efficiency: The progressive conservation movement, 1890-1920*. Pittsburgh: University of Pittsburgh Press.

Many scholars stress the top-down nature of such knowledge production.² The new forms of knowledge are seen as empowering scientists by investing them with a monopoly on scientific knowledge production,³ and the nature of the knowledge they produce leads to a variety of ends, from the de-politicization of political issues⁴ to Foucault's "governing effects,"⁵ to the erosion of social and environmental complexity.⁶ However, others have shown that local people were involved in shaping conservation⁷ and Progressive Era reforms in the U.S.⁸ This dissertation explores the relationship between local people and the knowledge production of early natural resource management agencies. It argues that seeing the complexities in this relationship modifies our understanding of the advent of state-based natural resource management in the U.S. The eastern U.S. oyster fishery is an ideal site to study this because the new system of knowledge production was integral to early state management, and oystermen had a long history of managing this resource through a variety of political activities and practical measures.

² Kirsch, S. 2002. John Wesley Powell and the mapping of the Colorado Plateau, 1869–1879: Survey science, geographical solutions, and the economy of environmental values. *Annals of the Association of American Geographers* 92 (3): 548-572. Scott, James C. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven: Yale University Press. Worster, Donald. 1985. *Rivers of empire: Water, aridity, and the growth of the American West*. New York: Pantheon Books.

³ Mitchell, Timothy. 2002. *Rule of experts: Egypt, techno-science, and modernity*. Berkeley: University of California Press.

⁴ Merkle, Judith. 1980. *Management and ideology: The legacy of the international scientific management movement*. Los Angeles: University of California Press.

⁵ Agrawal, Arun. 2005. *Environmentality: Technologies of government and the making of subjects*. Durham: Duke University Press.

⁶ Scott, 1998.

⁷ Judd, Richard. 1997. *Common lands, common people: The origins of conservation in Northern New England*. Cambridge: Harvard University Press.

⁸ Goodwyn, Lawrence. 1978. *The Populist moment: A short history of the agrarian revolt in America*. New York: Oxford University Press. Sanders, Elizabeth. 1998. *Roots of reform: Farmers, workers, and the American state, 1877-1917*. Chicago: University of Chicago Press.

To address this issue, I draw on works from the history of science that study the social construction of scientific knowledge.⁹ This body of scholarship tries to move beyond rigid realist or social/political determinist approaches by looking at the “co-production” of science and the social order.¹⁰ In this case the process of co-production by government specialists was contested, and this dissertation examines how this affected the knowledge production process and the transition to state management. I follow Arnold in identifying three questions important to address to see the socially constructed nature of scientific knowledge: what are the cultural influences on science, who produces knowledge and why, and how is science used to establish legitimacy and authority? For each of these questions, I will look at the relationship of local people, scientists, and state officials to the knowledge production process.¹¹

The research was conducted through archival investigation into the work of the early oyster and fish commissions of the federal government and the eastern section of the U.S. The dissertation looks at specific forms of knowledge production that mark the turning point into government management in the oyster industry and fisheries more generally. The scientists and commissioners produced knowledge concerning law enforcement (chapter 3), knowledge used for legislative advising (chapter 4), scientific knowledge on natural history (chapter 5), cartographic knowledge covering property and

⁹ Bowker, Geoffrey C. and Susan Leigh Star. 2000. *Sorting things out: Classification and its consequences*. Cambridge: MIT Press. Golinski, Jan. 1998. *Making knowledge natural: Constructivism and the history of science*. Cambridge: Cambridge University Press. Knorr Cetina, Karin D. 1981. *The manufacturing of knowledge: An essay on the constructivist and contextual nature of science*. Oxford: Pergamon Press. Latour, Bruno. 1999. *Pandora's hope: Essays on the reality of science studies*. Cambridge: Cambridge University Press. Hacking, Ian. 1999. *The social construction of what?* Cambridge: Harvard University Press.

¹⁰ Jasanoff, Sheila, ed. 2004. *States of knowledge: The co-production of science and social order*. London: Routledge.

¹¹ Arnold, David. 2000. *Science, technology, and medicine in India, 1760-1947*. Cambridge: Cambridge University Press.

biography (chapter 6 and 7), and knowledge of diseases spread by oysters (chapter 8).

Interpretive analysis of archival materials – including commission reports, scientific articles, personal papers and correspondences, newspapers, trade publications and magazine articles – focused on reconstructing the content of knowledge production and associated commission activities, as well as the historical, social and cultural contexts in which scientists and commissioners worked. I also used these documents to assess the relationship between oystermen and the new system of knowledge production. By focusing on individuals and documents that are relatively unstudied, and by looking at the relationship between local people and elite conservation science, this research contributes theoretically and materially to historical geography, environmental history and the history of science.

1.2 Research questions

- 1.) Knowledge production: what was the content of the new knowledge produced by professional scientists and government commissions, and what was the process producing it?
- 2.) Modernization: what role did the new knowledge and process play in the transition to state-based management between 1880 and 1920?

1.3 Theoretical context – literature review

I engage ideas from several bodies of literature that look at the advent of government natural resource management. The first is a review of the literature on U.S. Progressive Era resource management and its relationship to rural people's older

conservation practices. The second is a diverse body of work that looks at state management and rationalization. The third is literature from historical geographers studying the cultural history of cartography. The fourth section discusses works from science studies.

1.3.1 Progressive Era conservation

This study relies on Progressive Era historiography to provide background context.¹² Of particular importance was the shift from town to state or federal scale resource management, a transition central to the oyster fishery. The major factors forcing this shift were industrialization, urbanization, and population growth, and these forced changes in the oyster fishery as well. Improving efficiency was a common Progressive goal, but the new government agencies were often relatively weak in this period. All of these patterns were found in the oyster fishery as well.

Sanders argues that rural farmers led many reforms of the Progressive Era.¹³ They wanted state control over private wealth and power, and they wanted legislative regulations placed on the new bureaucracies that emerged to do this. This bottom-up influence helps connect the activities of baymen to larger patterns of Progressive reform. The wealthier portion of the fishery fits a different pattern. Large planters and packers formed national organizations that lobbied state governments. These fit the pattern for

¹² Chambers, John. 1992. *The tyranny of change: America in the Progressive Era: 1890-1920*. New York: St. Martin's Press. Wiebe, Robert. 1967. *The search for order: 1877-1917*. Westport: Greenwood Press.

¹³ Sanders, 1999.

capitalist agriculturalists involved in shaping flood control policy¹⁴ and the agricultural extension service.¹⁵

Progressive Era conservation has been traditionally seen as a creation of urban elites. Hays' *Conservation and the Gospel of Efficiency*, the first major work on Progressive Era conservation, focuses on the rise of professional conservationists and their middle-class urban backers.¹⁶ Hays stresses that Progressive reformers focused on efficiency goals as a response to the growing problems of their time. He notes that the resource management goal of maximum production through maximum efficiency, which would be determined by scientific experts, limited grass-roots involvement in conservation. Hays also notes that scientists tried to use expert knowledge to de-politicize resource management questions.

Judd helped move beyond Hays' formulation by showing that conservation practices did not begin with Progressive reformers; rural people developed conservation methods following widespread environmental change in Northern New England after the 1820's.¹⁷ He also shows that these methods went with specific ideas about nature and ethics, including equity in access to natural resource commons, particularly fish, game and forests. When growing industrialism led to increasing pressure on natural resources, Progressive conservationists brought their own ideas and practices (here Judd agrees with Hays), and the resulting conservation practices were a mix of the two. Judd thus stressed

¹⁴ O'Neill, Karen. 2006. *Rivers by design: State power and the origins of U.S. flood control*. Durham: Duke University Press.

¹⁵ Rosenberg, Charles E. 1971. Science, technology, and economic growth: the case of agricultural experiment station scientists: 1975-1914. *Agricultural History* 45 (1): 1-20. Danbom, David B. 1986. The agricultural experiment station and professionalism: Scientists goals for agriculture: 1887-1910. *Agricultural History* 60 (2): 246-255. Hamilton, David E. 1990. Building the associative state: The Department of Agriculture and American state-building. *Agricultural History* 62 (2): 207-218.

¹⁶ Hays, 1959.

¹⁷ Judd, 1997.

the importance of seeing how, when and where professional, progressive conservation interacted with earlier, rural ways of managing resources. Oysters were certainly a case where conservation pre-dated progressive reforms, and so this study follows Judd in looking closely at this encounter. It also builds on his ideas of the importance of equity and access, which appear in early oyster management too.

Jacoby presents a different model of the first interaction between rural people and conservation agencies.¹⁸ Where Judd sees the result of this encounter as a conservation system that combines elements from both groups, Jacoby stresses the conflict between state-sponsored conservation and rural people's pre-existing practices. Jacoby's emphasis on conflict leads him to identify the importance of surveillance and policing in Progressive conservation. Jacoby notes that "as New York officials soon discovered, managing the ecology of the Adirondacks was possible only if one monitored the daily interactions of local residents with the natural world."¹⁹ Rural people constantly broke conservation laws alien to their "moral economy."

Jacoby says that before progressive conservation, rural people "fashioned a variety of arrangements to safeguard the ecological basis of their way of life,"²⁰ and he stresses this to counter the tendency in U.S. environmental history to see conservation as founded by elites such as Gifford Pinchot. He notes that these earlier forms did not always work, and they included exclusion too. His important point is that progressive conservation "replaced a local, informal set of rules and customs relating to the natural

¹⁸ Jacoby, Karl. 2001. *Crimes against nature: Squatters, poachers and the hidden history of conservation*. Berkeley: University of California Press.

¹⁹ Ibid, p.129.

²⁰ Ibid, p.193.

world with a formal code of law, created and administered by the bureaucratic state.”²¹

He also notes the importance of violence needed to maintain both sets of rules.

Progressive conservation reserved legitimate violence for the state and led to conflict over protected areas. His case studies differ from Judd’s in that the rural people’s resource management systems never lasted as modern conservation areas pushed them out. Conservationists adopted an “authoritarian stance” toward rural people, and typically saw their methods with disdain.

The two works from fisheries that parallel Judd and Jacoby are McCay and McEvoy.²² In McCay’s case study of the New Jersey oyster fishery, older ethics and management forms were preserved through the courts as oystermen sought to “try the right” through civil disobedience and test cases. However in McEvoy’s study of the San Francisco Bay fisheries, the older management forms of balkanized immigrant fishing communities were supplanted by state managers who looked down on these “anachronistic” practices. As with Judd and Jacoby, these studies show both extremes of continuance and replacement. My case study is one where older forms existed, and McCay has shown the oyster fishery resembles Judd’s case, but the question here is whether and how this then influenced knowledge production. Keiner’s study of Maryland oyster politics has shown that oystermen were involved in blocking elite-led reforms, and this study builds on this story of resistance by looking at how this affected knowledge production.²³

²¹ Ibid, p.195.

²² McCay, Bonnie. 1998. *Oyster wars and the public trust: Property, law, and ecology in New Jersey history*. Tucson: University of Arizona Press. McEvoy, Arthur. 1986. *The fishermen’s problem: Ecology and law in the California fisheries, 1950-1980*. Cambridge: Cambridge University Press.

²³ Keiner, Christine. 2001. *Scientists, oystermen, and Maryland oyster conservation politics, 1880-1969: A study of two cultures*. Ph.D. diss., Johns Hopkins University.

1.3.2 Rationalism

Scott looks at cases where “high modernist” planners try to increase their control over society or nature by increasing visibility.²⁴ This drive for “legibility” leads to simplification, since simpler forests and cities are more visible to the state. The imperative to simplify thus derives primarily from the state’s need to centralize knowledge. These projects fail, according to Scott, because they undermine social and environmental complexity sustaining towns, farms, and other complex systems. Utilitarian Progressive Era environmental reformers had much in common with Scott’s high modernist planners. Indeed, Scientific Forestry, a classic example of Progressive conservation, is one of his main case studies.

Adas says Scott chose a set of similar case studies to illustrate his point, and he asks how different cases would modify Scott’s model.²⁵ This dissertation does this by looking at a case of state planning in a very different setting. Scott says that in his cases studies “civil society” is always “prostrate,” whereas in this case numerous oystermen were politically active and used to protesting. I explore what happens to high modernist planning and its attendant simplification when the local people have more power to resist or direct this process. Scott also says that in his model, local knowledge is replaced or overridden by the expert knowledge of high modernist planners. In the oyster fishery however, oystermen were able to influence environmental management, which meant the relationship between expert and local knowledge was more complex and negotiated. In this case, I show centralized knowledge production did not lead to environmental

²⁴ Scott, 1998.

²⁵ Adas, Michael. 2000. Seeing like a state. *Journal of Social History* 33 (4): 959-963.

simplification in the same way as in Scott's cases, and I will argue this was because high modernist planning was unable to guide knowledge production. This was due to the intractability of marine organisms, resistance from oystermen, and internal opposition from some of the oyster commissioners. Instead of aiding high modernist goals, state knowledge production helped to bureaucratize traditional management practices and yet preserved oystermen's preexisting practices and norms.

It is important to note that the "local people" are more diverse and divided in the oyster industry than in Scott's cases; planters ranged from the aquatic equivalent of small farmers working a few acres to rich capitalists who used steamships to harvest thousands of acres. Tongers were independent and numerous. They often engaged in other seasonal occupations, especially farming and bay fisheries. Tonging was important source of food for coastal farmers too, as well as for poorer members of coastal towns. Not only were there planters and tongers, but there was a separate class of "dredgers" in the Chesapeake Bay who harvested, often illegally, from oyster reefs but used larger ships and relied on wage labor. There were also "packers" who controlled the canning and packing trade. The wealthiest planters were packers too. There were important regional differences as well, especially between the northern and southern industries on the east coast. Differences in class-based interests meant that state attempts to bureaucratize "oystermen's" norms and traditions should not be seen as a romantic effort to protect rural people's way of life, but as a more complicated effort to preserve compromises that had evolved out of antagonism and interdependence.

Worster's *Rivers of Empire* examines the relationship between rationalization and resource characteristics, and I use it to explain one reason why oysters are an important

case study.²⁶ Worster says that the American West is a land of “imperial power.” This is due to the way scarce water resources allowed for an “ecological and social regimentation” that is “absolutely dependent on a sharply alienating, intensely managerial relationship with nature.”²⁷ It is a simplified, abstract order imposed to manage a difficult, unpredictable environment. It creates a “hydraulic society” run by a centralized, hierarchical elite who control capital and expertise. Worster explains that this is only possible because the state can centralize control over the main resource: water. Worster goes on to associate this type of resource management with the modern capitalist state, saying it is the barest expression of its tendency. He ties water commodification to “instrumental rationality” and the drive to maximize production.

Worster’s argument come from his engagement with Wittfogel’s *Oriental Despotism* and the Frankfurt School’s writing on instrumental rationality.²⁸ Wittfogel’s study of “hydraulic societies” influenced Julian Steward to think about how societies adapt to the environment, and Worster brought this same interest to his study of the American West. Worster says we need comparative irrigation studies to test his model. My research offers a comparison with a resource whose characteristics create nearly opposite conditions: the great oyster beds of the Western Atlantic. This resource is harder to bring under one group’s control, which is true for marine resources generally. Oysters cannot be centralized the way water can behind a dam, it is harder to exclude people from using them, and information on them is harder to obtain due to their being underwater.

²⁶ Worster, 1985.

²⁷ Ibid. p.5.

²⁸ Wittfogel, Karl. 1957. *Oriental despotism: A comparative study in total power*. New Haven: Yale University Press.

My point is that the environment functioned as an “actor,”²⁹ making it harder for a central technocratic elite to control the oyster fishery.

Max Weber’s distinction between formal and substantive rationality helps to explain Worster’s discussion of instrumental rationality in these first state resource management agencies.³⁰ Weber defines “formal rationality” as a technique or means relying on calculability that indiscriminately facilitates. Substantive rationality, however, is action guided by goals achieving ends that fit into a belief system. Weber does not provide criteria for judging the merits of these goals, but he sees substantive rationality as more ethical than formal rationality, as formal rationality is just a means, not an ends. He sees an inherent and insoluble tension between these forms of rationality. For Weber, Western society is organized around formal rationality, and he sees formal rationality’s indifference to values and ends as a peculiar feature of Western culture. Maximizing formal rationality is morally and politically problematic for Weber. He notes that people with less power try to limit formal rationality, as its results tend to favor the powerful. There is thus a tension between groups interested in benefiting from efficiency and those interested in the substantive regulation of social life. Weber says that the nature of formal rationality helps bureaucracies increase control, but it also increases irrational results and invites technocracy. The growing demand for specialized technical knowledge promotes both parts of this. Importantly for this dissertation, he notes that the growth of scientific knowledge lessens reliance on custom and replaces it with formal rationality. Following Weber, I will argue that commissioners’ and scientists’ efforts to bring formal rationality

²⁹ White, Richard. 1995. *The organic machine*. New York: Hill and Wang.

³⁰ Weber, Max. 1977. *Economy and society: An outline of interpretive sociology*. Berkeley: University of California Press. My reading of Weber is indebted to Brubaker (Brubaker, Rogers. 1984. *The limits of rationality: An essay on the social and moral thought of Max Weber*. London: George Allen & Unwin.).

to oyster management came into conflict with the ideal of regulating oystermen for various social goals other than efficiency. This dichotomy can be seen in the knowledge production process. The “gospel of efficiency” privileged formal rationality, but some commissioners and oystermen wanted to use knowledge production to bureaucratize traditional norms.

Princen’s *Logic of Sufficiency* provides the best examination of rationalism in the Progressive Era.³¹ He notes that efficiency (maximizing productivity for labor spent) became the main goal of many Progressive reformers, especially in natural resource management. They saw increasing efficiency and the public good as synonymous. However, this created problems because efficiency is “normatively neutral,” it can facilitate anything. Princen says the efficiency ideal caught on “because it appeared singularly capable of resolving otherwise inherently conflicting interests.”³² This was unrealistic, and Princen notes that rational pluralism is common, so “[d]ecisions that appear backwards or inefficient or wasteful can be, once the reasoning is played out, perfectly reasonable.”³³ The efficiency ideal also required the simplifying assumption that human motivations were rational calculations where individuals sought to maximize a single variable (usually money). This faith in efficiency’s power was based on “a worldview that is at once mechanistic and cornucopian.”³⁴

1.3.3 Historical geography

³¹ Princen, Thomas. 2005. *The logic of sufficiency*. Cambridge: MIT Press.

³² Ibid, p.64.

³³ Ibid, p.25.

³⁴ Ibid, p.110.

Historical geographers have recently begun producing extensive scholarship on the historical geography of science,³⁵ and this study utilizes tools from the study of cartography. Recent works on cartography follow Harley and others who treat historical maps as “texts” and examine the cultural construction of geographic ideas these maps contain.³⁶ Harley’s article “Deconstructing the Map” exemplifies this trend.³⁷ Works by Winichakul, Edney, and others all build on this by looking at how cultural history of cartography help us understand the spatial history of nations and colonies.³⁸ Maps were central to “the geographic construction of the colony,” making “colonial territory appear visible and stable.”³⁹ For Edney, the British trigonometric survey in India “was essential to how they thought of themselves and their rule.”⁴⁰ Their rhetoric was more important than reality, as the survey was never completed. It metaphorically said “that their science enabled them to know the ‘real’ India,” and as such was an assertion that British India was or could be a “rational and ordered space, which could be managed and governed in a rational and ordered manner.”⁴¹ In this research, the surveys of oyster grounds served a similar symbolic purpose, but they were usually completed and used.

³⁵ Evenden, Matthew. 2004. Locating science, locating salmon: Institutions, linkages, and spatial practices in early British Columbia fisheries science *Environment and Planning D* 22 (3): 355-372. Livingston, David N. 2003. *Putting science in its place: Geographies of scientific knowledge*. Chicago: University of Chicago Press. Naylor, Simon. 2005. Historical geographies of science - places, contexts, cartographies” *British Journal for the History of Science* 38 (1): 1-12. Powell, Richard C. 2007. Geographies of science: Histories, localities, practices, futures. *Progress in Human Geography* 31 (3): 309-326.

³⁶ Manners, Ian R. 1997. Constructing the image of a city: The representation of Constantinople in Christopher Buondelmonti’s *Liber Insularum Archipelagi*. *Annals of the Association of American Geographers* 87 (1): 72-102.

³⁷ Harley, J.B. 1989. Deconstructing the map. In Harley, J. B., ed. 2001. *The new nature of maps: Essays in the history of cartography*. Baltimore: Johns Hopkins University Press.

³⁸ Edney, Matthew. 1997. *Mapping an empire: The geographical construction of British India, 1765-1843*. Chicago: University of Chicago Press. Winichakul, Thongchai. 1994. *Siam mapped: A history of the geobody of a nation*. Honolulu: University of Hawaii Press.

³⁹ Ryan, Simon. 1996. *The cartographic eye: How explorers saw Australia*. Cambridge: Cambridge University Press. p.6.

⁴⁰ Edney, 1999. p.9.

⁴¹ Ibid, p.3 and p.34.

Several scholars have begun developing more varied case studies using similar tools.⁴² Carter discusses surveys, and focuses on the difference between explorers' views and the views of those who read their reports and maps.⁴³ Unexplored areas were a problem for colonial administrators; they wanted colonial spaces that were "defined, settled, productive," but explorers saw and sought out unknown places and had personal encounters with them. Carter stresses this is different than just seeing the state as constructing "a disciplinary panopticon for its scorned and feared subjects."⁴⁴ He rejects previous studies that see colonial history as simply unrolling a map over local people. Carter's advice to look closer at this process, and especially to see it in a less linear way, influences this research. This dissertation looks at a case where local people had the ability to influence some of the surveys, and it argues that these surveys preserved, in a codified, rational form, traditional compromises over property rights within the oyster fishery.

1.3.4 Science studies

Historians of science have been for some time concerned with the social aspects of science.⁴⁵ To better understand this, I have relied on Hull's discussion of how scientists choose between rival views, which he sees as the central question of the history

⁴² Burnett, D. Graham. 2000. *Masters of all they surveyed: geography, exploration, and a British El Dorado*. Chicago: University of Chicago Press. Carter, Paul. 1987. *The road to Botany Bay: An essay in spatial history*. Boston: Faber and Faber. Lane, K. Maria D. 2005. Geographers of Mars: Cartographic inscription and exploration narrative in late Victorian representations of the red planet. *Isis*: 96: 477-506.

⁴³ Carter, 1987.

⁴⁴ Ibid, p11.

⁴⁵ Shapin, Steven and Simon Schafer. 1985. *Leviathan and the air-pump: Hobbs, Boyle, and the experimental life*. Princeton: Princeton University Press. Traweek, Sharon. 1988. *Beamtimes and lifetimes: The world of high energy particle physics*. Cambridge: Harvard University Press.

of science.⁴⁶ In the oyster case, there were two views of oysters and aquaculture science, one of which was cornucopian (which almost all scientists followed) and the other more ecological. Hull moves beyond the division between internalist and externalist explanations, (i.e., those who emphasize the role of scientific evidence or social factors respectively) to explain why scientists side with one perspective over another. Hull believes that it is difficult or impossible to prove why scientists make these choices in historical research, and so instead he advocates looking at “intellectual lineages,” noting that “concepts must be treated as lineages.”⁴⁷ Showing how these are passed on is still difficult due to loss of evidence and the indeterminate nature of what remains. Hull also advocates looking for “enabling conditions” instead of strictly causal factors. In the case of oyster science, I am looking at a specific intellectual lineage: the ideas supporting aquaculture science and increased planting as the solution for the oyster industry. Following Hull, this research identifies enabling conditions that promoted these ideas and their particular evolution.

One enabling condition is the cultural context of Progressive Era fisheries management. Another is what Drayton identifies as a colonial narrative of enclosure and improvement, which equated privatization with progress.⁴⁸ A final, closely related, theme, explored most fully by Adas, is based on an hierarchical evaluation linking a society’s progress to industrial technology.⁴⁹

⁴⁶ Hull, David. 1988. *Science as a process: An evolutionary account of the social and conceptual development of science*. Chicago: University of Chicago Press.

⁴⁷ Ibid, p.17.

⁴⁸ Drayton, Richard. 2000. *Nature's government: Science, imperial Britain, and the 'improvement' of the world*. New Haven: Yale University Press.

⁴⁹ Adas, Michael. 1989. *Machines as the measure of men: Science, technology, and the ideologies of western dominance*. Ithaca: Cornell University Press.

Another key enabling condition was the way Progressive Era knowledge production related to the way scientists and commissioners sought legitimacy and authority. The seminal work on the growth of professions is Abbott's *The System of Professions*, and even though Abbott is not a historian of science, his work is historical and it covers scientific professions, which helps explain how and why professional groups try to legitimate their authority.⁵⁰ He notes that professions compete with one another. They make "jurisdictional claims" over certain areas or problems, and they do this by defining these in abstract ways that fit their particular domain. This is important for oysters, since zoological and fishery scientists were actively trying to establish their profession and this may have led to simplifying claims about causes of oyster decline and solutions to this problem. Abbott also says professions must have support of relevant audiences to retain legitimacy, and in America the key audience is usually the public or some segment of it. This need to gain legitimacy and support for their jurisdictional claims may have been factors affecting oyster scientists' choices. Professionalization implies a simultaneous standardization and expansion of knowledge, as well as a limitation of who can produce knowledge deemed useful for management, which has political implications. In this case, I stress how the need for abstract jurisdiction claims, and the need to make these palatable to a divided oyster industry, shaped knowledge production.

Porter furthers our understanding of the relationship between the need to establish legitimacy and the production of quantified knowledge.⁵¹ Quantification increases the

⁵⁰ Abbott, Andrew. 1988. *The system of professions: An essay on the division of expert knowledge*. Chicago: University of Chicago Press.

⁵¹ Porter, Theodore. 1995. *Trust in numbers: The pursuit of objectivity in science and public life*. Princeton: Princeton University Press.

appearance of objectivity, which helps establish trust and legitimacy in a situation where this is difficult. Porter notes that quantification “tends to miss the interested, located individual” and his knowledge, and he stresses its connection to centralized planning.⁵² My study looks at the way high modernist oyster scientists and government officials used quantification to argue for the legitimacy of their plans.

Historians of science are also interested in who produces knowledge and why. Sivaramakrishnan’s *Modern Forests* explores a complex case of knowledge production for colonial conservation, and my research is patterned after this study.⁵³ Sivaramakrishnan notes that colonial forestry depended on technology, law, and knowledge working together, but none were able to fully assert control because nature and people resisted them. Colonial scientists partitioned landscapes; forest management constructed categories of communities and expertise, and valorized certain kinds of knowledge. However, colonialism was a patchy process with mixed success. Therefore the author calls for more attention to micro-processes and regional variation. He discusses the “two-systems, two-cultures” model of colonial environmental interventions, and his case study leads him to call for “less determinist and linear environmental histories.”⁵⁴ Part of this includes seeing how the production of knowledge was not simply something that colonial officials produced free from interaction with others. Sivaramakrishnan studied the “points of knowledge production, codification and transmission” to advance the idea that “environmental development discourses are

⁵² Ibid., p.85.

⁵³ Sivaramakrishnan, K. 1999. *Modern forests: Statemaking and environmental change in colonial Eastern India*. Stanford: Stanford University Press.

⁵⁴ Ibid, p.15.

continuously under production through entanglements about the locus of governance.”⁵⁵ He is concerned with “localized production of information, and the process of translating it into standard terms, that made possible a project like scientific forestry,” and he says we need to pay more attention to place and outcome because “[t]he terrain of implementation leaves a strong impression on the production and transmission of scientific knowledge,” and “[t]he gap between outcome and intent...was the product of the constraints imposed by particular geographies, histories and cultures.”⁵⁶

To expand on Sivaramakrishnan’s more complex model of expert-local interaction, I rely on the idea of co-production. Jasanoff notes that scientific knowledge and the social order co-produce one another.⁵⁷ Scientists’ ideals affect the kind of knowledge they produce, and this in turn affects social order in a reciprocal way. In this case, I look at how scientists’ and commissioners’ ideals about property, progress, and tradition affected the knowledge they produced, and how this then affected the fishery’s management.

1.4 Methodology and sources

This study looks at the U.S. East Coast oyster industry during the Progressive Era (1880-1920). I chose this region because it was the center of the industry during this time and for many years afterwards, and it thus drew significant attention from government agencies and professional scientists. The first task was to reconstruct the output of the knowledge production process and the changes in management, and the second step was

⁵⁵ Ibid, p.244.

⁵⁶ Ibid, p.245 and p.243.

⁵⁷ Jasanoff, Sheila, ed. 2004. *States of nature: The co-production of science and social order*. London: Routledge.

to then to look for the context of these patterns. Historians of ideas recommend seeing larger cultural ideas as contexts or conditions leadings to actions, rather than as causes,⁵⁸ and this study will adopt that approach, as it fits well with Hull's recommendation to look for enabling conditions. The rest of this section discusses the major types of sources: 1.) commission reports, 2.) scientists' papers and correspondences, 3.) scientific journals, 4.) professional organization proceedings, 4.) laws and petitions, and 5.) newspapers and trade publications. I used these sources to reconstruct knowledge production and management changes, and the dissertation chapters are organized around types of knowledge production. I adopted a comparative case study approach, comparing each type of knowledge production to the others.⁵⁹ Each chapter is written as a narrative, which is a common form of explanation in social science and environmental history.⁶⁰

State and federal agency reports

In the Progressive Era, a widely varied group of new state agencies began trying to regulate the oyster industry and produce knowledge about it. The first of these date from the 1860s, and they become common at the federal level in the 1870s, and at the state level in the early 1880s. The new agencies fell into three major categories: 1.) the Chesapeake Bay oyster navies, 2.) the state fish and oyster commissions, and 3.) the U.S. Fish Commission (USFC).

The Chesapeake oyster navies were law enforcement agencies. The Maryland navy wrote reports on its activities. In addition, tidewater newspapers frequently reported

⁵⁸ Barzun, Jacques and Henry Graff. 2004. *The modern researcher*. Belmont: Wadsworth.

⁵⁹ Creswell, John. 2003. *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks: Sage Publications.

⁶⁰ Lewis, D. 1986. *Philosophical papers*, vol. 2. New York: Oxford University Press. Cronon, William. 1991. A place for stories: Nature, history, and narrative. *Journal of American History* 78 (4): 1347-1376.

the navies' activities. Newspapers are essential because they cover corruption within the Maryland navy better than its internal reports. Other state enforcement agencies were either the oyster commissions or state game wardens.

The state oyster and fish commissions were a heterogeneous set of agencies. Some were temporary and other permanent. Some were staffed by scientists, others by appointed officials. Some served solely in an advisory capacity, whereas others were regulatory. Among their duties were assessing and collecting taxes, mapping property, and writing regulations. Many left detailed reports of their work. State legislatures were the main audience for these, so the commissioners may have exaggerated their own effectiveness to maintain funding, or they may have done the opposite to ask for more. The reports are the main source for tracking knowledge production by these entities; they contain much of this new knowledge and they provide the best record of what the commissions did. Since the reports often seek to advise the legislature and justify their action, they provide evidence of the commissioners' ideas about modernization, although this decreases once the commissions' role becomes settled. There was also a National Association of Shellfish Commissioners, and they published their annual meetings' proceedings, which are another valuable source on oyster commissioners' opinions and ideas. Commissioners also wrote articles for magazines and newspapers. Some commission reports also discussed local reactions to their work.

The USFC was heavily involved in modernizing oyster management and their reports are a rich source as well. However, their jurisdiction precluded actual management and advising in state waters so they took the lead in mapping and natural science. The USFC reports and bulletins (scientific findings published separately) are the

best source documenting the content of oyster science and surveys. Together, agency reports are the best source for documenting the content of state knowledge production.

Correspondence and papers

The other important source for tracing oyster scientists' activities and ideas is their correspondences and papers. The National Archives is the source for almost all of the federal scientists' correspondences. Only a few scientists left personal papers to archives, but when available, these are a key source.

The correspondences have several limitations. The National Archives cover federally employed scientists better than state scientists, but this is not a significant problem, as most scientists working on oyster conservation were affiliated with the USFC. The vast majority of these correspondences discuss mundane matters; a large number are receipts of funds or requests for money. The ones containing the views of scientists also often refer to persons or events in a way that is difficult to follow due the lack of precise designation. In other words, correspondents often refer to people and events in a short hand way that they understood but that the modern reader is unable to interpret. Letters with political content are also hard to interpret, as writers may have lied for a variety of reasons. There are also significant gaps; some scientists wrote more than others. Scientists who felt their views went against the grain may have been less inclined to voice these ideas, leading to a false sense on uniformity. These issues need to be kept in mind when interpreting scientists' correspondences and papers, and problems with specific people and letters will be discussed in detail later.

Scientific journals

Oyster scientists often published in scientific journals. Many scientific articles by scientists were published directly in the USFC Bulletins. However, scientists published in a wide variety of journals. To find relevant articles and track the content of oyster science, I relied on Paul Galtsoff's bibliography.⁶¹ Galtsoff was a leading oyster scientist who published the most comprehensive bibliography on oyster science (it contains over 17,500 entries).

Professional association proceedings

Oyster commissioners founded the National Association of Shellfish Commissions in 1909. The annual proceedings provide information on the views of many individuals working in the state agencies. They sometimes document knowledge production too, as many scientists and commissions presented scientific and technical papers at these meetings, but most of this knowledge production is better covered in other sources. Select papers and speeches from these meetings were published as annual proceedings. These also document involvement of certain segments of the industry that attended and presented at these meetings, especially the national Oyster Growers and Dealers Association.

Laws and petitions

The evolution of oyster laws is well-preserved in this historical record. However, laws were often not enforced; indeed this was a chronic problem in the industry. The laws therefore do not provide a blueprint for actual conservation practices. What they do show

⁶¹ Galtsoff, Paul. 1972. *Bibliography of oysters and other marine organisms*. East Kingston: G.E Hall.

are measures certain sections of the industry thought would help improve economic or environmental conditions. They provide evidence of what some people saw as the industry's principal problems and solutions. Often one can infer what segment of the industry wanted the law by its contents. A law legalizing dredging would be favored by oystermen who fished with dredges for instance. Despite their limitations, laws are the best source for reconstructing pre-Progressive Era attempts at conservation and management on a multi-state scale, and this dissertation uses them for that purpose.

Petitions to state legislatures provide a useful window into why local people wanted certain laws prior to the Progressive Era. They only show what the literate part of that community wrote of course, but many who signed may have been average baymen. The difficulty with these sources is their accessibility. Only Virginia's are indexed. In other states one must hunt through them, which is extremely time consuming for such a narrow topic. In addition, some states' petitions are poorly preserved. Since this study does not need a complete picture of the older management, which would indeed require its own research project, I have only used the Virginia petitions. These corroborate much of the picture assembled through other sources.

Laws fail to correspond with practices in one other way. Many fishing communities follow informal rules. Such practices leave fewer traces. One source is town newspapers, which are discussed below. The first commission reports often refer to informal rules as well. Taylor documents these informal rules in the West Sayville, New York, oyster fishery, and since this is the most detailed ethnography of a nineteenth century oystering community, it is likely these existed elsewhere to.⁶² McCay documents

⁶² Taylor, Lawrence. 1983. *Dutchmen on the bay: The ethnohistory of a contractual community*. Philadelphia: University of Pennsylvania Press.

informal rules in the New Jersey oyster fishery too.⁶³ Taylor and McCay are the two main academic sources providing ethnographic description of the nineteenth century oyster fisheries, and they will also be used to contextualize the references to informal rule found in the primary sources.

Newspapers and trade publications

Newspapers recorded local activities, especially conflicts, and local perspectives through editorials. There are methodological problems with using newspapers however. Coverage is uneven and the number of potential papers is so large that it is impractical to search newspapers systematically for a fifty year period across a large region. Therefore this dissertation only uses newspapers as a supplement to other sources. The newspapers used were located either through references in other sources, or, in the case of the *Baltimore Sun*, *New York Times*, and *Brooklyn Daily Eagle*, their availability on electronic databases.

The second methodological problem with newspapers is bias. Many editors had obvious bias. Some of these are obvious and easy to detect, as when an editor makes favorable or disparaging comments on a letter he has printed. The bias itself can be a form of evidence too. The more difficult problem is that bias leads to partial coverage. For instance, a paper may only print the tongers' point of view and the problems they face. The best way to avoid being misled is to have multiple sources, but this is rarely possible for small scale issues and a researcher must proceed with caution. Major patterns, such as the decline of dredgers from northern states working in the Chesapeake

⁶³ McCay, 1999.

Bay, can be confirmed by multiple sources. Despite the problems of bias inherent in these sources, they still provide a valuable picture of local perspectives and action.

There were two major fishery trade publications that covered the oyster fishery between 1880-1920: the *Fishing Gazette* (1884+) and the *Oysterman and Fisherman* (1905-1914). The Library of Congress has a complete set of the *Fishing Gazette*. The New York Public Library has the only remaining (incomplete) copies of the *Oysterman and Fisherman*. The magazine *Forest and Stream* frequently carried articles on oyster science and management as well.

Since newspapers alone cannot be used to reconstruct local people's involvement in knowledge production, I rely on a mix of sources listed above. Trade publications sometimes provide helpful information, but the single most useful source for this is still the commission reports, which frequently discuss this issue. They often allude to interactions they do not fully explain, but they do discuss these enough to provide a general picture of the commissions' interaction with both planters and tongers.

1.5 Chapter outline

The chapters are arranged around types of knowledge production. Chapter two, on oyster management before 1880, provides necessary background information.

Chapter 1.) Introduction: research question, literature review, sources, and methods

Chapter 2.) The oyster industry and management before 1880

Chapter 3.) Surveillance knowledge and law enforcement

Chapter 4.) Knowledge for legislatures: commissions as advisors

Chapter 5.) Natural science knowledge: reproductive biology and artificial cultivation

Chapter 6.) Cartographic knowledge: mapping oystermen's property

Chapter 7.) Cartographic knowledge: mapping natural beds

Chapter 8.) Knowledge of oysters and epidemiology

Chapter 9.) Conclusion

Chapter two: oyster management before 1880

2.1 Introduction: local management of oysters

This chapter presents an overview of oyster management from Massachusetts to Virginia prior to the advent of the commissions (c.1880). Although the research question focuses on the Progressive Era, it is necessary to know what was being done before this since the dissertation examines the relationship between traditional management practices and the commissions. The chapter is divided into four sections. The first provides brief background information on the fishery. The second documents oyster conservation laws to show contemporary thinking about conservation practices. The third discusses evidence found in legislative petitions. The fourth uses a wide variety of sources (newspapers, trade publications, early government reports, and academic literature on the period) to describe and explain regional differences and interactions.

Judd's New England study is the best description of pre-Progressive conservation, and McCay's New Jersey study is the best study of the nineteenth century oyster fishery.¹ Early New Jersey oyster management was similar to Judd's New England case in that rural people were worried about sustainability and the decline of the resources, and they developed solutions for this problem. Judd and McCay stress the importance of equity and access for rural resource-dependent communities. Oyster management across the eastern states had the same pattern. Oysters were easy to harvest and were thus an important source of money and food for the poorer members of coastal communities, and early management measures sought to preserve their access to the resource. In addition, many coastal towns depended on oysters, and these communities sought to preserve access to the economically important oyster beds. McCay and Judd show that preserving

¹ Judd, 1997. McCay, 1998.

access meant excluding outsiders, and these traditional management measures grew out of conflict. Pre-commission management thus revolved around maintaining access for locals and excluding outsiders. There was also a desire for recognizing private rights; oystermen “planted” oysters by moving them to locations where they grew faster, and “planters” wanted exclusive rights to these aquaculture farms. Private rights to oyster farms clashed with public rights to natural oyster beds.

Oyster planters’ rights were based on the Lockean idea that one takes ownership of nature by mixing one’s labor with it. This was only possible on a frontier, or a place where no one already exercised a right to the same space or object. Common property rights to natural oyster beds also evolved from the U.S.’s frontier heritage. As McCay notes, U.S. common right to fisheries and wildlife resources grew out of displeasure with Old World enclosures and the vastness of resources in the colonial U.S.² These two frontier traditions dealt with access and exclusion in different ways, and oyster ecology ensured they would meet and compete in U.S. bays. Traditional management grew out of oystermen’s conflict over space, conflicts that drew on the principles of the U.S.’s two main frontier property ideologies.

2.2 Background on the oyster fishery

The American oyster, *Crassostrea virginica*, is found from Prince Edward’s Island in Canada south into Mexico. It was most common from Cape Cod through the Chesapeake Bay. Oysters live in shallow water. They are filter feeders that eat microorganisms and organic matter. Where they are abundant they form dense reefs or

² McCay, Bonnie J. 1987. “The culture of the commoners: Historical observations on Old and New World fisheries” in McCay, Bonnie J. and James M. Acheson, eds. *The question of the commons: The culture and ecology of communal resources*. Tucson: University of Arizona Press.

beds and they are important for filtering organic matter out of the water and providing habitat for aquatic animals. Oysters produce large numbers of spawn, and the few that survive mature in one year, but keep growing for several more.

Oystermen harvested oysters in a variety of ways. The main way was through “tonging.” Tongers harvested oysters with rake-like implements in shallow water from small boats (see figure 2.1 and 2.2). Usually there was only one or two persons per tonging boat. Another important form of harvesting was known as “planting.” As mentioned above, planters moved oysters from places where they spawned well to areas where they would grow faster. They grew faster because they were spread out and because many of these places were ideal for adult oysters but had predators that would kill younger ones. These predators, such as drills and drum fish, were less common in low salinity areas where oyster reefs typically lay. Planters often used larger boats and crews, and they often employed dredges for taking up oysters (see figures 2.3 and 2.4). Dredges were chain link baskets with teeth on one end that were dragged along the bottom until filled with oysters. The dissertation describes tongers, planters, and other members of the fishery in more detail later.

2.3 Oyster laws before 1880

Oyster laws contained similar provisions across the eastern states. These similarities suggest common solutions to the problem of depleted oyster beds. However, there is ample evidence that nineteenth century fishermen often disregarded laws, so laws are an unreliable guide to what people were actually doing. This section discusses laws as a body of evidence that represent a common understanding of how to deal with depletion,

but that by themselves do not show widespread conservation practices. The sources used in this section are the collected statutes of each state. The bibliography contains a complete list of these.

Lime

Among the oldest conservation measures were those prohibiting gathering oysters for lime. Oyster shells were a valuable source of crop fertilizer, but oystermen argued harvesting for this purpose depleted beds. Some states allowed farmers to purchase old shells from packing houses. New York's lime law passed in 1658 (apparently the US's first oyster conservation law), Rhode Island's in 1734, New Jersey's in 1775, Massachusetts' in 1796, and Virginia's in 1804. These laws attest to very early concern over and awareness of depletion. All of the states in this study adopted lime laws.

Closed seasons

All the states in this study also had a summer closed season. Closed seasons were a crucial conservation mechanism designed to let juvenile oysters develop a hard shell before they were handled by hard metal tongs and dredges. Since oysters spawn in the spring or summer, harvesting was prohibited during these times and immediately thereafter. Closures lasted from April or May until August, September, or October, depending on the location. These laws were not only a conservation measure however; there was also a widespread belief that, due to the timing of reproduction, oysters were unfit for food in months without an "R," which depressed the summer market.

The main difference between states was timing. Oysters spawn earlier in the warmer southern waters, and so closed seasons tended to begin and end earlier there. The oldest closed season law was New York's, which exempted Native Americans. It was passed in 1715. New Jersey passed theirs in 1719, Massachusetts in 1834, Virginia in 1836, Rhode Island in 1864, and Delaware in 1873. Many states also prohibited oystering at night, which was done to aid enforcement. Some also prohibited oystering on Sundays.

Harvest limits

States set harvest limits in bushels per day. The limits were partly a conservation measure and partly an equity mechanism designed to spread the harvest among more people. The most important of these applied to harvesting in the closed season. Most states allowed harvesting for home consumption during the closed season, but restricted the amount (usually to about five bushels a day). One reason for this was so that people harvesting oysters for their own food would continue to be allowed to do so. It was also thought this practice was not a threat to the oyster beds, due to its small scale. It reflected a widespread value; it was right to allow local people to use fish and game resources when they were for home consumption and not for market sale. This right was seen as especially important for the poor, as they were the ones who depended most on these resources.

Cull laws and size limits

Cull laws required oystermen to sort or cull their harvest on the boat, throwing overboard old shells and undersized oysters. These had to be thrown back at the same

place where they were harvested. Oyster larvae float for a short period and then settle on the bottom of the bays, and if they alight on soft mud, they sink into it and die. They require a hard substrate for their initial attachment, and old shells provide this. Culling shells was important to maintaining the oyster population because shells provided the essential attachment sites for the next generation of oysters, and they provided it in places where it was known oysters could reproduce. Whereas many laws combined conservation with equity and access concerns, cull laws were passed purely for conservation purposes. Most states, but not all, adopted these, but usually later than many other laws (New Jersey in 1845, Rhode Island in 1852 for example). In addition to cull laws, some states had size limits. Oysters had to be thrown back if they were undersized. A common size limit was two and a half inches. Oyster spawn when one year old, so many undersized oysters were breeders. Size limits were a way to ensure there were oysters left to breed and replenish the reef.

Gear and vessel restrictions

Laws frequently outlawed or regulated dredges. Dredges' greater capacity meant they were also more likely to completely deplete oyster beds. In addition, dredges could harvest more oysters faster, and this left fewer oysters for everyone else. Since dredges needed bigger boats, and more people to work them, and because both of these required more money, widespread dredging would help the wealthier segment of the industry harvest a disproportional amount of the resource. All states passed dredge bans at one point or another. Sometimes these restricted dredges to deeper waters where tonging was

impossible, other times they banned dredges completely. Sometimes dredges were allowed on planting leases, but banned elsewhere.

Vessel restrictions fell into two types: laws prohibiting large vessels and laws prohibiting steamships. Both were designed to limit dredging, as these boats were used to pull larger dredges faster, and larger ships were not used for tonging. As with many laws, vessel and dredge restrictions mixed sustainability with equity and access concerns.

Local management and residency requirements

One of the most important features of nineteenth century oyster law was residency requirements. These stipulated that a person had to be a resident of a certain location for a prescribed period, usually one year, before they could harvest oysters. These laws often stipulated that boat owners had to be local residents too. The purpose was to limit access to the oysters to local communities. Residency laws were found in all states, but they differed in how they defined residency. In New York, New Jersey, Delaware and Rhode Island, this was generally by state, whereas in Virginia and Maryland residency was defined by county. In Connecticut and Massachusetts, residency was defined by town.

Residency requirements were only half of the pattern of local management. Once a town or county had excluded outsiders, the state proceeded to pass provisions within laws that applied only to those specific parts of the state. These laws usually applied to towns, counties or bodies of water. They were often written in response to petitions from these locations. In Connecticut, the state gave towns the right to author their own oyster ordinances in 1766. Massachusetts developed a system of town management in the 1860s and 70s too. New York had local laws, some of which were based on peculiarities of

colonial grants on Long Island. In the Chesapeake, local laws were extensive and often quite detailed. For instance, part of an 1876 Maryland oyster law limited harvesting for family use to five bushels a day in June, July and August in Dorchester County, but exempt the Great Bay of the Little Choptank River. The same law reserved a specific bed in the Wye River for Queen Anne and Talbot County residents, and also issued a dredge ban for boats within four hundred yards of shore past a certain line in the Wye. These local stipulations were often rewritten yearly in the Chesapeake. Like many fisheries, these laws were based on preserving local people's access by simultaneously limiting it for others.³

Planting laws and leasing

Oystermen frequently moved oysters around, and some of the greatest challenges for nineteenth century conservation revolved around transportation. There were two main forms of this. The first of these was a practice often referred to as “fattening” (or “floating,” “drinking,” etc.). Oystermen placed their catch in fresher water, usually near the mouth of a creek, where the difference in density and salinity caused the oysters to absorb water and “fatten.” They also tended to expel sediment. Many consumers preferred the taste and texture of fattened oysters. Fattening only took a day or two, but oyster were also left in these locations for much longer as a way of storing them close to markets.

“Planting” was a very different practice. As discussed earlier, planters took small oysters, often those under one year old, from oyster beds and moved them to areas where

³ McCay, Bonnie. 1989. Sea tenure and the culture of the commoners. In *A sea of small boats*. J. Cordell ed. Cambridge: Cultural Survival.

they would grow more rapidly. They might keep them there for a single winter, or for two years or more. Faster growth was the main motivation, although oystermen would move oysters to have them closer to markets.

Ingersoll presented persuasive evidence that Native Americans living along the Gulf of Maine planted oysters on a small scale.⁴ However, the first recorded experiment with transplanted oysters was in 1711. Thirty persons placed oysters in Plymouth harbor in an unsuccessful attempt to form an oyster bed.⁵ The next evidence of planting comes from Rhode Island. In 1798, the state granted two acres.⁶ In New Jersey, planting started in the Shrewsbury and Navesink River area around 1808.⁷ From there, it seems to have spread north to New York Harbor in the 1810s or 20s.⁸ Leasing plots to oyster planters began on a regular basis in 1822 in Rhode Island and 1830 in Delaware. Virginia first legalized planting, in Middlesex and Matthews Counties, in 1836. Planting was less important in Maryland, and it is hard to know when it began there.

Planting laws developed in response to the spread of planting; the practice usually preceded the law. Laws allowed people, usually state residents, to plant oysters in certain locations and gave them the property rights over these oysters. Sometimes the state would lease these areas. Frequently though, oystermen simply claimed them through use or squatters rights. Riparian owners usually had precedence. Oystermen could dispute claims in areas that had natural beds however, as these were not open to planting claims. This of course raised vexing questions of how one defined a natural bed, a subject dealt

⁴ Ingersoll, Ernst. 1882. *The history and present condition of the oyster industry*. Washington, D.C.: Government Printing Office. p.11-16.

⁵ Ibid. p.21-22.

⁶ Rice, Michael A. 2006. *A brief history of aquaculture in Rhode Island*. Coastal Resources Management Council. p.24.

⁷ McCay, 1998. p.30.

⁸ Ingersoll, 1882, p.112. *Brooklyn Daily Eagle*, November 9, 1883. Kurlansky, Mark. 2006. *The big oyster: History on the half shell*. New York: Random House. p.208.

with extensively in chapter six. The amount of underwater land one could claim varied from one acre to an unlimited quantity, and the leases' duration varied as well. Planters were sometimes except from harvesting laws, such as dredge bans and closed seasons, on their own property.

Taxes

The first oyster tax was in Plymouth in 1661, which placed a tax on exported oysters. Despite this early start, pre-1880 taxes on oysters were rare. There was a large, short-lived, tax on exported oysters in Virginia in 1858-9, but other than this, oysters were generally not taxed before the Progressive Era. The exception was in Maryland and Virginia, who levied a tax to pay for their oyster navies after 1868. From 1868-74, Virginia also used this tax to collect a substantial amount to pay for their war debt. Delaware had a tax after 1871 too.

Enforcement provisions

Enforcement provisions varied between states. Many allowed oystermen to make arrests whenever they saw violations. Penalties could be steep, including the confiscation and sale of vessels. Money generated from vessel sales and fines was sometimes given to those providing information or catching the guilty parties. Maryland law allowed oystermen to form *posse comitatus* to apprehend lawbreakers. In several areas, oystermen hired their own guards to protect planted beds. Oystermen often followed laws selectively and enforcement was generally weak before the advent of oyster navies and other

government management agencies. One reason for this, in the Chesapeake at least, was that the laws were numerous and constantly changing, which created confusion.

2.4 Virginia's legislative petitions

Virginia has a collection of petitions that provide unique insight into oyster laws. Unlike other states in this study, Virginia has preserved and indexed an extensive collection of petitions (over 22,000) sent to the state legislature. Petitioners asked the legislature to pass or change laws. They also explained why oystermen wanted certain laws. There are a total of seventy two petitions related to oysters. They ask for most of the same provisions found in the laws above.

The most common requests in the petitions were for changes in who could access oyster beds. One of the main themes was the desire to enforce the ban on large northern boats and “northern men with large capital [who] fill up our waters.”⁹ Sometimes these bans included northerners who ran planting operations in Virginia. There were several exceptions to this pattern. Chincoteague Island residents claimed they depended on the northern boats to buy their oysters and asked the legislature not to restrict this trade. There were also several petitions asking the legislature to repeal the dredge ban and to allow northern boats access. Many of these were immediately answered by petitions stating that the pro-dredging authors were not average oystermen but were wealthier persons who would benefit from increased dredging. These contested petitions show that views were not uniform, and they show conflict over the law's content.

Many petitioners requested laws for their specific locations, usually counties. Often they asked for laws modeled on ones in other counties. There was an element of

⁹ Petition to the Virginia Legislature from citizens of Gloucester County, 1850.

competition or conflict driving the spread of these place-specific laws. Several petitioners said oystermen who had laws, such as closed seasons, were gaining an unfair advantage by harvesting oysters in other counties. For instance, a Lancaster County petition said people from places with local residency requirements were taking oysters from Lancaster County in summer and carrying them back to their protected counties. The petitioners said many of them depended on oysters, and in a few years their beds would be destroyed by this practice. They recommended a county residency requirement for the whole state.¹⁰ A few petitions criticized local laws on the principle that public waters should remain the common property of all Virginians. One discussed a North River law saying it “operates as a monopoly” and if this continued in other places the whole state would be “monopolized.” It stated local residency requirements ran contrary to “common property” traditions.¹¹ The petitions confirm the desire for local laws, but they also show a variety of ways of thinking about the relationship between access and residency.

Access concerns were closely tied to ideas of equity expressed in petitions. Petitioners often described the poor’s dependence on oysters. One said oysters were the poor’s “chief stock of food” and called illegal dredging “a practice already seriously afflicting the poor and threatening to demoralize the labouring part of the whole community.”¹² Another said “that with us, oysters are food for the poor, whereas when carried away, they are used only as luxuries for the rich” (underlining in the original).¹³ The general pattern was to claim the petitioners were ordinary oystermen asking for laws that would benefit them and protect them from wealthier individuals, sometimes adding

¹⁰ Petition to the Virginia Legislature from citizens of Lancaster County, 1846.

¹¹ Petition to the Virginia Legislature from citizens of Gloucester County, 1848.

¹² Petition to the Virginia Legislature from citizens of Accomac County, 1818.

¹³ Petition to the Virginia Legislature from citizens of Northampton County, 1831.

the importance of the laws for the poor. When petitioners discussed equity concerns, they frequently expressed fear of monopolies. A standard petition stated,

but the proposed law in giving to individuals the right to acquire property in the planting grounds in the public waters will produce a change in the rights of the people fraught with the most serious consequences to your petitioners, for under the operation of such a law it will not be long before the whole of the public waters and bottoms suitable for planting oysters would be monopolized by a comparatively few while the poor and laboring population will be driven from the rivers.¹⁴

The main fear was that planters or dredgers would take more oysters and would earn more money, out-competing the tongers.

Another common theme was lack of law enforcement. Petitioners described oyster laws as “totally ineffectual” and “so imperfect and defective that they are violated with impunity.”¹⁵ Petitioners gave several reasons for this. For one, “vacillation and continual change” in the laws created confusion.¹⁶ Another explained “[t]hat in consequence of the many changes in these laws they have become so complicated that it has been almost impossible to ascertain what they allow and what they prohibit.”¹⁷ Other petitions cited the large number of violators, and their “spirit of taunt and bravado towards the civil authorities” that had grown because of the “uniform success which has attended all attempts to evade these” laws.¹⁸ Another said capturers needed better compensation, and another that fines were too low, but most focused on confusion and profusion in the laws and the violators’ disregard of civil authorities.

Petitions (and laws) reflected the perception that oysters could decline. This view occurs frequently in the Virginia petitions. For instance, Gloucester County petitioners

¹⁴ Petition to the Virginia Legislature from the citizens of Gloucester County, 1845.

¹⁵ Petitions to the Virginia Legislature from citizens of Lancaster County, December 1832, and Accomac County, 1852.

¹⁶ Petition to the Virginia Legislature from citizens of Isle of Wight County, 1851.

¹⁷ Petition to the Virginia Legislature from citizens of Nansemond, 1849.

¹⁸ Petition to the Virginia Legislature from citizens of Northampton County, 1831.

wrote that they had “reasons to fear the total loss” of their beds, saying non-residents “will entirely destroy the oyster beds.”¹⁹ Ingersoll noted that oystermen knew about local cases of bed exhaustion in all oyster regions.²⁰ However, Keiner has recently shown that many Maryland oystermen argued oysters were inexhaustible.²¹ Keiner’s evidence runs counter to the general pattern, and the difference is due to Maryland’s more extensive oyster beds. A closely related debate, seen mainly in the Chesapeake, was whether dredging harmed beds. Many people felt dredging helped expand oyster beds by breaking them up and spreading them out. One petition explained this idea:

Were it true there was the slightest prospect for years or even for centuries of the destruction of these beds under the operation of this trade [dredging] they would forgo the advantages derived from it, for the general good – and without a murmur, but experience has fully satisfied them that the beds are not only exhaustless, but the oysters have regularly improved during the entire period when they were being removed from the waters of the Rivers.²²

Here the beneficial effects of dredging were linked to the inexhaustibility of the beds.

While the view that dredging spread beds seems to have been common, others argued that too much dredging could harm beds by not leaving enough oysters to reproduce.

Both sides cited the case of specific beds to back up their ideas. This debate shows how ecological ideas varied, but it also shows widespread fear of resource exhaustion, a fear implied in much oyster law.

One unexpected finding in the Virginia petitions was the link between oyster law enforcement and slavery. Several petitions from different years and locations asked for bans on northern boats because they were “corrupting” slaves. These petitions said northerners were making slaves rebellious by giving them drink, talking to them about

¹⁹ Petition to the Virginia Legislature from citizens of Gloucester County, 1830.

²⁰ Ingersoll, 1882.

²¹ Keiner, 2001.

²² Petition to the Virginia Legislature from citizens of Essex County, 1847.

freedom, and encouraging them to pilfer poultry and grain for the ships' crews. The slaves were also working too hard oystering, principally at night, which made them too tired to work well on the farm. The most detailed of these petitions gives a sense of oystermen and slave owners' fear of the larger repercussions of this issue (blanks mark illegible words):

This trade is continued almost exclusively by citizens of other states whose institutions and manners in many ways differ from our own; and they are in general men of that sort who are neither very scrupulous in principle nor very cautious in conduct. Such is the force of public opinion among us ____, that very few of our white citizens engage in supplying their exports, so that they are dependent chiefly on our slaves and free negros. The former labor for them only in the night whereby they are rendered unable to labor for their owners in the day, and in the course of a few years, are laid up with rheumatism and other diseases of a premature old age. In some instances, valuable slaves have been drowned, in pursuing this business too eagerly in the dark and inclement night. Moreover they are paid for the work past in ardent spirits whereby they soon become habitual drunkards. This intemperance is still further ____ by the temptations to theft which the ____ ____ out to them, by either purchasing the stolen goods, or by conning their masters to dispose of them aboard. In this manner they render our slaves partially worthless. But even this is not the worst. Thrown by the nature of this pursuit, into continual contact with other classes – and that too, in the secrecy of night – and interested to win their confidence as far as possible, what can be more natural than to attempt this by injurious comments upon their condition, and affected sympathy in their supposed oppressions?²³

The petitioners went on to describe the emancipation movement's activities and support in their own county. The authors felt the movement was planning violence. They then return to the northern oyster boats, saying

No agent can be more perfectly suited to this work than the oyster traders. Their ____, their night operations, their ignorance, their prejudice, their total ____ of all common feeling or common interest with ourselves; their frequent ____ and ____ ____ our slaves and the northern whites...Nothing can be easier than for them to incite the most dangerous opinions and distribute them with incendiary writings, without the possibility of detection. With equal ease they can evade detection, and convey intelligence from place to place, whereby the most extensive conduct can be prepared.²⁴

²³ Petition to the Virginia Legislature from citizens of Northampton County, 1831.

²⁴ Ibid.

This type of petitions shows that traditional management should not be romanticized. It was quite compatible with slavery.

Several themes in the petitions (and laws) conform to the secondary literature on nineteenth century conservation. Early fishery laws were a reaction to Old World enclosures.²⁵ The experience of enclosure, coupled with laws restricting fish and game based on hereditary privilege, led U.S. immigrants to desire more egalitarian access to fisheries, and the vastness of U.S. resources made this possible. Rhode Island's colonial charter reserved the right for the state's citizens to have "ffull and ffree power and liberty to continue and vse the trade of ffishing vpon the sayd coast, in an of the seas thereunto adjoyninge, or-any armes of the seas, or salt water, rivers and creeks, where they have been accustomed to ffish."²⁶ Connecticut passed a law regulating weirs in 1716, saying they were a nuisance to migrating fish. Massachusetts passed a law in 1641 providing free access to fish and fowl from ponds, bays, coves, and rivers for persons near the town where they live, unless prohibited by that town. Conservation laws came later to the South. Virginia's first fish conservation law was passed in 1746. It required chutes for shad around Rappahannock River mills, and was soon extended to other rivers. An 1803 Virginia law prohibited dams, weirs, traps, hedges, etc. from obstructing fish passage. It said the Great Falls of the Potomac "afford convenient opportunities to evil-minded persons" and allocated funds to hire a watchman from March until June. The Public Trust doctrine developed out of these same ideas.²⁷ In it, the state was seen as hold public lands in trust for the public, including oyster producing bays. This basic pattern extended to

²⁵ McCay, 1987.

²⁶ Charter of Rhode Island and Providence Plantations, July 15, 1663. Retrieved February 2, 2007 from The Avalon Project at Yale Law School at <http://www.yale.edu/lawweb/avalon/states/statech.htm>.

²⁷ McCay, 1989.

other resources, and by the mid-nineteenth century, laws protecting game birds, deer, fish and terrapins were common in the eastern states.

Judd showed that early conservation in New England focused on equity, access, and sustainability, all of which are seen in oyster laws.²⁸ Restrictions on gear and residency aimed to spread harvests more broadly among local people while excluding outsiders. Closed season, lime laws, and cull laws sought preserve the resource for the future. Petitions confirm the purpose of these laws. Oyster laws thus fit the pattern seen in the literature on U.S. nineteenth century resource management.

2.5 Regional patterns in the oyster fishery before 1880

2.5.1 The Gulf of Maine

In the 1700s, Wellfleet, Massachusetts was the center of the northernmost oyster fishery.²⁹ It had a productive oyster fishery, with natural oyster reefs and oysters brought in the summer to store for the Boston market, but most of their oysters died around 1780 from an unknown cause.³⁰ Boston was one of the larger oyster markets, and Ingersoll estimated over 5,000 people were employed in the city's oyster trade.³¹ By 1880, Gulf of Maine beds were almost extinct.³² Cultivation failed as a remedy for decline in most of the Gulf of Maine, as frosts, rocks, starfish and other factors retarded planting north of the Gulf Stream.

²⁸ Judd, 1997.

²⁹ Ingersoll, 1882, p.21-25.

³⁰ Thoreau wrote, "Various causes have been assigned for this, such as ground frost, carcasses of black-fish, kept to rot in the harbor, and the like, but the most common account of the matter is, - and I find that a similar superstition with the regards to the disappearance of fish exists almost everywhere, - that when Wellfleet began to quarrel with the neighboring towns about the right to gather them, yellow specks appeared in them, and Providence caused them to disappear." Thoreau, Henry David. 1985 [1865]. *Cape Cod*. New York: Penguin Putnam. p. 906.

³¹ Ibid, p.27-31.

³² Ingersoll, 1882, p.16-23.

2.5.2 Northern Long Island Sound

In Northern Long Island Sound, over-harvesting depleted natural beds in many locations. Several Narragansett Bay beds were gone, as were large natural beds in parts of Connecticut. In some cases this was rapid. Oystermen discovered a large set on the Potowomut River in 1872, and soon after its discovery, tongers rushed to the bed and harvested all the oysters. This would be the river's last significant set. Harvesting activities such as these showed more concern with access than preservation. On many beds, people would gather, often from far inland, along the shore to tong oysters on November 1st when the season opened. Large crowds would then rush in and compete for oysters.³³ Such harvesting methods were common, and they show a tension between the desire for access and sustainability. Despite these problems, large natural beds remained in many areas. The largest of these was at Norwalk, which had a three mile long oyster bed.³⁴

Unlike in the Gulf of Maine, planting succeeded in Long Island Sound. Planters occupied leases granted by towns. Leasing and planting began in the Providence River in 1822. In Buzzards Bay, leasing was in place by the 1830s. In Connecticut it is harder to say when leasing began. Most planters lived in the towns where they worked, except in Buzzards and Narragansett Bays, where Boston merchants leased much planting ground until they were expelled in the 1840s. Sometimes exhausted beds were taken up for planting, such as Great Bed near the end of the Providence River, which was exhausted

³³ Ibid. p. 36-87.

³⁴ Ibid. p. 36-87.

around 1850 and became one of the larger planting areas. The acres they leased varied. Some planters worked one acre plots and others were firms planting large areas.³⁵

New Haven's packing industry

New Haven Bay's packing industry was central to the history of the entire east coast fishery. There were once natural beds around the bay, and so a tonging industry developed. An early packing industry developed based on these natural beds. Oysters were sent inland in barrels, traveling all the way to Albany and then westward over the Erie Canal. New Haven oystermen were some of the first to bring southern oysters to their packing houses. Each packing firm built branch-houses in major inland cities, such as Chicago and St. Louis.³⁶ New Haven packers were the first to develop an extensive packing industry, and this enabled them to dominate the U.S. packing trade well into the Progressive Era.

Oysters were "shucked," or taken out of the shell, by women and boys. Shucked oysters were washed and packed in wooden casks or metal tins. Early on, casks were used in cold weather and tins in warm weather. Tins were stored in a cold room, and then packed together in a wooden container with space for a block of ice in the middle. By Ingersoll's time only tins were used. Packing was such an extensive industry that de Broca (a French scientist sent to survey the U.S. oyster fishery) estimated that in 1863

³⁵ Ibid. p.46-87.

³⁶ Ibid. p.61. Kochkiss, John M. 1974. *Oystering from New York to Boston*. Middletown: Wesleyan University Press.

one hundred fifty persons were employed in two factories that made only casks and tins for the oyster industry. This trade was carried on predominately in the winter.³⁷

At its peak, New Haven may have processed over one million bushels annually, but production had dropped to about 450,000 bushels in 1879. By that time, most of the oysters supplying New Haven's packing industry came from the Chesapeake. Referred to as the "Southern" or "Virginia Trade," this movement of oysters north peaked in the decade before the Civil War.³⁸

Deep water cultivation

As New Haven Bay was taken up by planting claims, planters began moving into deeper water beyond the bay. On the north side of Long Island Sound, much of the bottom close to shore was regularly swept by strong currents and tides, which keeps the ground clean, presenting a sand or gravel surface that was ideal for oyster cultivation, as sediment deposition can easily smother young oysters. This "deep water" cultivation was carried out within sight of shore, but in water too deep to tong. Henry Rowe first cultivated oysters in the Sound in 1865, and after his example deep water planting expanded rapidly, spreading to Narragansett Bay too. It required much more capital than shallow water planting or tonging. Deep water tracts needed to be at least fifty acres to be profitable. Planters used buoys within plots to mark where to work. Often planters would also place shells in the water to catch summer spat and increase their beds. Planted beds were frequently disturbed by storms (buoys were also lost), and predators attacked their

³⁷ Ingersoll, 1882, p.61. de Broca, P. 1876 [1863]. On the Oyster Industry of the United States In *Report of the Commissioner of the United States Fish Commission*. Washington, D.C.: Government Printing Office.

³⁸ Ibid. Ingersoll, 1882, p.61-67. Kochkiss, 1974, p.15-24.

oysters. Despite the risk from storms and starfish, planters found deep water planting highly profitable.³⁹

When they were ready for harvest, most deep water oysters were taken up by dredges. The catch was then culled, and dead oysters, assorted shells and other debris thrown back. Sailboats used wind power to pull the dredge over the beds, and then the crew pulled the dredge on deck, laden with oysters and working against the wind. The difficulty of the work is one reason planters turned to steam. They began using steamships in the late 1870s. William Lockwood built the first ship expressly for dredging. It had two dredges that could take up one hundred fifty to two hundred bushels a day. By 1879 there were seven steamers working Connecticut deep water beds.⁴⁰

Deep water planting was an attractive conservation model for several reasons. It was immensely productive for the first few decades. However, deep water planters suffered from the classic problem of monoculture farming: they produced the perfect environment for pest population explosions. Planters fought a running battle with starfish or “five fingers,” eventually inventing a mop-like instrument that snared the starfish when dragged over the bed. They used these to haul up and kill vast numbers of starfish, and this reduced their populations temporarily, but in the 1910s and 1920s starfish returned in unprecedented numbers and destroyed the deep water planting beds. Henry Rowe, the largest planter and the industry’s leading organizer, was so distraught by the collapse of the Connecticut planting fishery that he retired to Florida and died. But no one saw this coming in 1880, and deep water planting was held up as the most productive,

³⁹ Ingersoll, 1882, p.63-70. Kochkiss, 1974, p.15-24.

⁴⁰ Ingersoll, 1882, p.80-81. Kochkiss, 1974, p.132-133.

most lucrative, fastest growing part of the fishery, and it seemed to prove that the solution to oyster conservation problems lay in expanded planting.

Connecticut also looked like a promising conservation model because it never had an “oyster war.” There were frequent disputes over property rights between planters and tongers, but these never reached the proportions found in other regions. One reason was that there were fewer natural beds left when planting began. For example, the South Norwalk natural beds were depleted in the 1850s and planting began once they were gone.⁴¹ Just as important was planters’ expansion into deep water, which tongers never used and had no reason to fight for. Deep water cultivation would prove difficult to copy though, as it took advantage of the way ice sheets had carved the northern coast, bringing deep water close to shore. The Chesapeake’s broad, shallow expanse of flooded river valleys presented opposite conditions. However, the basic idea of dividing bays based on ecological conditions was intuitive and developed elsewhere too. It was a simple spatial division, and it worked best where the bays could be divided into tonging and planting zones based on clear biophysical differences. Where it did work, it created a new agricultural frontier for the planters.

Another reason for lesser conflict was the availability of Chesapeake seed, which took pressure off Long Island Sound natural beds. The New Haven packers relied heavily on the Southern Trade at its peak, and this put much pressure on the Chesapeake Bay fishery (see section 2.3.7). It was an extraction of natural resources, without regard to any conservation practices, from a resource-rich region to a more industrial one. It led to a much illegal harvesting and conflict in the Chesapeake, even as it took pressure off the

⁴¹ Ingersoll, 1882, p.86.

Connecticut natural beds. This displaced class conflict and subsidized the New Haven industry.

2.5.3 The mid-Atlantic

This region was ecologically varied and planters adapted to local conditions. For instance, in Jamaica Bay, planters had to contend with shallow inlets and shifting sands. Because of the small, shallow channels, most work was done from skiffs or flat planting boats. The shallow bay also left oysters vulnerable to being ground by ice during winter low tides. Oystermen planted oysters as early as possible and took up all oysters at the start of winter. They built special storage houses on the banks of the tidal creeks. These had ponds dug in them that admitted salt water, and, by keeping the temperature up in the storage houses, they could store oysters in these for winter sale. The channels in the bay also changed frequently, so valuable land could be worthless a year later, or vice versa. The watchmen took advantage of the many islands to build huts next to the oysters.⁴² Ecology also made this region home to the most prized oyster varieties. Consumers recognized oyster “brands,” which looked alike but had distinct flavors imparted by the location where they grew. The most famous were Great South Bay’s “Blue Points,” and other notable brands included Babylon’s “Oak Islands,” Raritan Bay’s “Sounds,” “Keyports,” and “Amboys,” and Jamaica Bay’s “Rockaways.”

Towns granted and leased planting property throughout this region. Blackford noted that in New York there was a widespread misconception that a state law gave a person could claim unoccupied land simply by planting oysters on it. Despite their lack of

⁴² Blackford, Eugene. 1885. Report of the Work in an Oyster Investigation with the Steamer Lookout. In *Report of the Commissioner of the United States Fish Commission*. Washington, D.C.: Government Printing Office. p.27-30.

legal backing, courts upheld these claims, considering them common law. New York planters seldom made maps or kept record of these, but they had few conflicts, and they bought and sold these without any legal title. Their plots were usually less than twenty acres, but some were over one hundred.⁴³ In New Jersey, the state legislature granted Shark River the right to appoint a committee to make planting grants in 1861, which was an unusually early example of legislatively-authorized town management.⁴⁴ Some New Jersey towns, such as West Creek, set up planting plots without formal legal title.⁴⁵ Planters formed protective associations and hired watchmen in both states.

The tonging fishery was important in this region. Some oyster beds were depleted by 1880, especially in New York. These exhausted New York beds often became planting grounds. Many beds remained however, some of which were extensive. For example, Ingersoll estimated the main bed in Barnegat Bay was ten miles long and two miles wide, and another nearby bed at the mouth of the Mullica River was several square miles in size. Both of these were important seed suppliers for New Jersey planters. Ingersoll estimated the Barnegat Bay tonging fishery directly employed one thousand out of the Tuckerton's eighteen hundred persons.⁴⁶

Tonging and planting interests tended to divide bay space between them in this region. There were places where ecological conditions aided this. In Great South Bay, New York's most productive area, the western end of the bay was better for the rapid growth of adult oysters, and thus planting, whereas the eastern end had extensive natural

⁴³ Ingersoll, 1882, p.88-120. Blackford, 1885, p.11.

⁴⁴ McCay, 1999, p.105-106.

⁴⁵ *New Jersey Courier*, April 3, 1873.

⁴⁶ *Ibid.* p.88-155.

beds. Oystermen took advantage of this by moving oysters from east to west.⁴⁷ Delaware Bay, New Jersey's most productive oystering area, had a similar pattern. Oysters propagated better in the lower salinity upper bay and grew faster in the high salinity lower bay. In 1871 the legislature divided planting grounds from the natural beds along the "Southwest Line."⁴⁸

Despite these divisions, there were frequent disputes between planters and tongers over property and access. But the planter versus tonger divide is an over-simplification. Long Island farmers also argued on the side of tongers in some cases. They wanted access to natural beds so they could gather oysters for winter. It was common for farm families to take a wagon to the coast and gather a barrel of oyster to store for the winter. In some places, especially in New Jersey, clammers clashed with planters, taking on the role of tongers and allying with them. In both states, colonial claims complicated ownership. Residents battled with non-local dredgers who illegally took oysters too. Planters were often former tongers. There were thus many kinds of "tongers," and planters varied too; some only farmed one acre, whereas others were millionaires with large holdings.

Two books provide ethnographic insight into oystermen's complex interaction in this region. McCay has shown that New Jersey tongers were politically active. They gathered in groups and went to the state capital to argue for protecting traditional rights to the natural beds. They used mass civil disobedience to create test cases in the courts. Acts of civil disobedience, usually taking planted oysters, were common as well. For instance,

⁴⁷ Ingersoll, 1882, p.98-107.

⁴⁸ Ingersoll, 1882, p.144-153.

Ingersoll reported that planting was common at the Mullica River by the 1830s, but had declined to a very small amount due to widespread sentiment against privatization.⁴⁹

Taylor's *Dutchmen on the Bay*, an ethnohistory of the oystering community in Sayville, looks at the complex tonger-planter relationship. Sayville tongers depended on oysters, but had other fishery occupations to supplement their income. One of these was working for wages on the planting grounds. There were few truly independent baymen; public bed tongers worked closely with their capitalist planter counterparts. The leading planters had started as tongers, and many tongers wanted to follow in their footsteps. Conflicts over the location of natural beds versus planting areas were common, as was illegal harvesting from planted grounds. Both group argued over wages too. In Sayville, both groups shared Dutch immigrant backgrounds, churches, and a sense of identity as baymen. Taylor believes Sayville oystermen's ethnic isolation and cultural traditions helped mitigate class conflict, as did their sense of shared baymen identity.⁵⁰

Delaware's oyster fishery was comparatively small. It was mostly owned by Philadelphia merchants.⁵¹ The Philadelphia market brought in around 2,500,000 bushels in 1879, making it a rival to New York City and Baltimore. The wholesale trade was controlled by about fifty firms, most of whom are also Delaware Bay planters.⁵² New York City's market had grown to where Ingersoll estimated there were two hundred ships involved in bringing oysters to New York City. Ingersoll estimated the city sold 2,699,000 bushels. He estimated the retail trade supported five thousand families.⁵³ New

⁴⁹ Ibid. 134-143. McCay, 1999.

⁵⁰ Taylor, 1983.

⁵¹ Ibid. p. 1445-153. Miller, Mary E. 1962. *The Delaware oyster industry, past and present*. Ph.D. diss., Boston University.

⁵² Ingersoll, 1882, p.154-155.

⁵³ Ibid. p.121-134. Kurlansky, 2006.

York City merchants also shipped to Europe after 1870. Blue Points were the most popular variety in Europe, and most of the oysters shipped there came from near New York. They were packed tightly with the deep side down to preserve their liquor. Shippers followed elaborate rules to protect live oysters in passage, including banning loud noises on board. Liverpool was the main destination. There were European inspectors who would taste shipments to make sure they were actually Blue Points, Rockaways, etc.⁵⁴

2.5.4 The Chesapeake Bay

The Chesapeake Bay had the largest oyster beds in the U.S. and probably the world.⁵⁵ At its peak around 1890, the Bay produced 39% of U.S. oysters, accounting for 17% of the total U.S. fishery by volume, and employed 20% of the U.S. fishing industry.⁵⁶ The combination of extensive shallow water, ample nutrients, abundant microorganisms, and low salinity was perfect for oysters. Scientists estimate oysters filtered the entire volume of the Bay every three or four days, and in doing so kept organic matter levels low so light could penetrate the water and nourish the aquatic vegetation that so much Chesapeake Bay life needs.⁵⁷

New Haven packers shaped the Chesapeake Bay's nineteenth century oyster fishery. The "Southern Trade," or "Virginia Trade," was the name for the flow of oysters from the Chesapeake to the north. Northern ships first began harvesting Chesapeake

⁵⁴ Ingersoll, 1882, p.130-134.

⁵⁵ MacKenzie, Clyde L. 1996. History of oystering in the United States and Canada, featuring eight great oyster estuaries. *Marine Fisheries Review* 58 (4): 1-78.

⁵⁶ Kennedy, V.S., and L.L. Breisch. 1983. Sixteen decades of political management of the oyster fishery in Maryland's Chesapeake Bay. *Journal of Environmental Management* 16 (2): 153-171.

⁵⁷ National Research Council. 2004. *Nonnative oysters in the Chesapeake Bay*. Washington, D.C.: The National Academies Press. p.15.

oysters in the first quarter of the nineteenth century. It is hard to gauge the magnitude of this early harvesting. By 1850, Connecticut packers were taking Chesapeake oysters in large numbers, shipping these inland after packing them at New Haven and elsewhere in their state. The Southern Trade began by supplying oysters for market (mostly for packed oysters), but as the Connecticut seed supply diminished, the Southern Trade soon began supplying northern planting beds as well. Deep water cultivation started in Connecticut in the 1860s and much of the seed oysters came from the Chesapeake. The Southern Trade peaked in the 1850s.⁵⁸ In 1858 Virginia's state's chief oyster inspector estimated that 8,800,000 bushels left the state through this trade.⁵⁹

The Southern Trade was lucrative, and it led to much illegal dredging. Maryland and Virginia, like most other states, banned dredging on natural beds, but the state had no way to deter dredgers. Articles from the *Baltimore Sun* suggest the scope of the problem. In 1851, the newspaper reported three schooners and one sloop captured. These Philadelphia boats were sold as punishment.⁶⁰ In 1853, three more Philadelphia boats were caught and sold.⁶¹ In 1859, Annapolis was "thrown into unusual excitement" over the capture of ten schooners after chartering steam vessels to catch them. Nine were from Philadelphia and one was from Baltimore. They were sold, with one quarter of the money going to pay court costs, another quarter to the informers, and half to the crew who helped catch them (about twenty people). An armed military crew was dispatched to keep owners from freeing their boats.⁶² These articles are a sample showing the typical pattern

⁵⁸ Ingersoll, 1882, p.66. Wennersten, John R. 1981. *The oyster wars of Chesapeake Bay*. Centerville: Tidewater Publishers. p.13-16.

⁵⁹ *Baltimore Sun*, January 28, 1859, p2.

⁶⁰ *Baltimore Sun*, October 27, 1853, p.4 (from the *Annapolis Republican*).

⁶¹ *Baltimore Sun*, January 25, 1853, p.4.

⁶² *Baltimore Sun*, December 24, 1859, p.4 and December 26, 1859, p.1.

where illegal dredgers came in groups, and large heavily armed parties were needed to capture them. They hailed mostly from Philadelphia, with New York, New Jersey, and Baltimore boats also among the guilty. The Southern Trade was at its peak, which explains the presence of northern boats, but most planters from New York north used Virginia seed, whereas Philadelphia planters relied more on Maryland seed that came through the canal. Heavy fines and even boat forfeitures were ineffective deterrents for wealthy packers in the 1850s.

Virginia's petitions explained why enforcing the dredge ban was so difficult. Often, dredge boat captain made it known they had guns and every intention of defending their ships. Captains worked in groups, and often used watch boats to spot other boats coming to enforce the law in time to evade them or pull up dredges. There were also legal loopholes. Once dredges were aboard, captains could claim to have legally purchased oysters.⁶³

The Civil War disrupted the fishery, and it also gave the natural beds several years to rest. When the war ended, Maryland repealed its dredge ban. Lawmakers may have done this to aid the packing industry, or to revive harvests more generally and thus supply work. Maryland's economy was badly disrupted by the war and people needed jobs. The new law required all dredge boats to obtain licenses, and boat owners had to be Maryland residents. Dredgers also had to work beds away from county waters, as these

⁶³ In Virginia there was a provision allowing the sale of oysters to out of state vessels under certain sizes. The idea behind this was to allow the sale of the sale of seed oysters to northern planters, without allowing dredging. Dredging required larger boats, so the size prohibition was meant to allow a profitable trade many communities depended on while limiting destructive dredging. Dredging cut out the tongers, so Virginians received no money for their oysters when northerners dredged them.

inshore areas were reserved for tongers. Maryland also founded an oyster navy (see chapter three) and prohibited steamships from the fishery.⁶⁴

Captures of illegal dredge boats continued after legal dredging began in Maryland. For instance, the *Baltimore Sun* reported that in January 1868 nine mostly Philadelphia-owned boats were caught dredging in county waters.⁶⁵ An 1869 article discussed “great consternation” over the capture of six boats at Deal’s Island.⁶⁶ Such articles were common in the later 1860s and 1870s. Dredge boats crews were generally treated poorly and forced to work in dangerous conditions. Crews generally came from poorer classes in the cities. Captains had a share of the profits, which was a further incentive to break the law.⁶⁷ Dredgers continued to supply the northern industry during this time, but the Southern Trade waned for three reasons: locals opposed and fought illegal dredgers, Connecticut’s rested seed beds rebounded, and New Haven packers shifted their operations to the Chesapeake to be near their sources. This shift meant that even as the Southern Trade declined, illegal dredging continued, as dredgers turned to supplying the Baltimore packing industry.⁶⁸

Baltimore’s packing industry was founded by New Haven men. Caleb Maltby was the first New Haven packer to move to the Chesapeake. He opened Baltimore’s first packing house in 1834 or 1835, shortly after the arrival of the Baltimore and Ohio Railroad. He also shipped oysters in wagons to Pittsburgh. By 1850 many more New Haven packers had opened houses in Baltimore, as had local investors. Baltimore would

⁶⁴ There was also an attempt to monopolize the oyster beds at this time. In 1860, a small group of Maryland legislators passed a little-noticed law granting 600,000 acres to a few individuals. Oystermen discovered their plan and had the law repealed, afterwards calling a convention to fight monopolies.

⁶⁵ *Baltimore Sun*, January 21, 1868 (from *St. Michael’s Comet*).

⁶⁶ *Baltimore Sun*, January 29, 1869 (from *Princess Anne True Marylander*).

⁶⁷ *Ibid.* p.156-165.

⁶⁸ Ingersoll, 1882, p.156-173. Wennersten, 1981.

become the country's largest packing center, and Maltby would become rich as the city's leading packer. Henry Rowe was also one of Baltimore's largest packers. Several sources claim Connecticut planters/packers dominated ownership of the Baltimore packing industry. The Baltimore packing industry had a reputation as one where men made rapid fortunes in the nineteenth century.⁶⁹

Baltimore's packing industry produced 1,875,000 bushels packed in the shell and 1,360,000 bushels of canned oysters in 1865, according to Caleb Maltby. According to Ingersoll, by 1869, fifty-five packing houses canned 5,000,000 bushels and employed seventy-five hundred persons, and sixty "raw" houses employed three thousand more packing steamed oysters. Daily oyster trains with thirty to forty cars left Baltimore in the peak season and the city dominated the western trade. Ingersoll's 1879-1880 figures for Baltimore were as follows: 9,543 vessel landings (37 per day), 7,252,972 bushels landed, 6,459,000 bushels packed, 819,000 bushels eaten in the city, and 45 firms employing 4,167 males and 2,460 females. Ingersoll estimated the total Maryland yield at 10,600,000 bushels in 1879. He estimated (very roughly) that 55,000 people were supported by oysters in Maryland.⁷⁰

Crisfield was Maryland's other large packing center. John Crisfield was the president of the Eastern Shore railroad, and he made sure the line connected to Somer's Cove, Crisfield's old name. Prior to its arrival, he bought up much land around the town. It was an ideal location for an oyster packing industry, as it was in the center of many major oyster beds. To expand the town and provide wharfs on the water, oyster shells were used to fill marshes, leading people to joke, accurately, that Crisfield was built on

⁶⁹ Ingersoll, 1882, p.165-173. Wennersten. 1981.

⁷⁰ Ingersoll, 1882, p.165-173.

oysters. The railroad arrived in 1867. Its packing industry mushroomed from non-existent in 1866 to shipping several million bushels a year in the 1870s. By the 1870s, Crisfield had over six hundred ships and shipped several million bushels annually. The rapid growth, when combined with Maryland's law enforcement problems, led to a general culture of lawlessness in Crisfield, which is commonly cited in town histories.⁷¹

Packing house workers, called "shuckers," were a different group from oystermen. Packing oysters was seasonal work, and many of the shuckers went to work on farms or worked packing fruit during others seasons. In the Maryland, about three-fourths were African Americans. About one fourth were women, most of whom were immigrants or the daughters of immigrants (mostly Bohemian and Irish). Few native-born women would do this as both sexes and colors mingled indiscriminately in the workplace. Shuckers worked with knives at tables opening oysters. Their pay was low and they developed unique health problems. The *Baltimore Sun* reported on several strikes in Baltimore and Crisfield. There is no mention of any solidarity or assistance from oystermen in these events. Ingersoll estimated that Baltimore packers employed 6,180 male and 2,460 female shuckers, and that 17,000 people depended on shuckers' wages.⁷²

Tonging employed more men and less capital than dredging, but they were paid better than dredge boat crews and were more law abiding. Most tidewater oystermen were tongers, not dredge captains or crew, which more often hailed from the cities. Most tongers lived on or near the water and owned homes. Their incomes came primarily from oysters. About one third were African American. Ingersoll estimated there were over

⁷¹ Wennersten, 1981, p.18-28.

⁷² Ingersoll, 1882, p.169.

5,000 tongers in Maryland. He reported that tonging was quite profitable from 1865-75, but prices had dropped somewhat after that.⁷³

Unlike Maryland, Virginia did have a planting industry. Planters preferred to harvest with tongs because it was easier for them to enforce property rights. They tended to stake planted beds. Seed for planting came from local beds.⁷⁴ Most planters and tongers were not part-time farmers; they made most of their living from oysters. African Americans dominated the tonging fishery in many places, and most oystermen were born in Virginia. The James River was the most productive tonging ground; all of it had oysters, especially the shoals. Ingersoll estimated there were about 4,400 canoes and skiffs (tonging boats), 1,300 larger ships, and 14,200 men employed in Virginia (about half tongers, half planters), over half of whom were African American. Virginia tongers tended to use smaller boats than in other areas.⁷⁵ Much Virginia planting was initially owned by northerners, who hired locals to work the beds but owned the boats and oysters. Northern ownership gradually declined after the Civil War. Packing began at Norfolk in 1859, but did not take off until 1865. According to Ingersoll, the total Virginia yield was around 6,837,000 bushels, supporting 16,000 families in 1880.⁷⁶

Although planters and tongers fought over space throughout the eastern oyster fishery, this pattern was different in the Chesapeake. Planting was rare in Maryland because of the likelihood of having one's oysters stolen by dredgers. It was also hard to define natural beds (see chapter seven), so tongers defended rights to almost the whole

⁷³ Ibid. p.156-165. Maryland also had a "scraping" fishery. "Scraping" was just dredging with smaller dredges and boats in shallower water. Scrapers caused fewer problems and had better treated crews than the dredge boats. There was also a "patent tong" fishery. Patent tongers used chains to lower tongs in deep water and used a pulley to operate the tongs.

⁷⁴ Ingersoll, 1882, p.180-187.

⁷⁵ Ibid. p.181-185.

⁷⁶ Ibid. p.185-187

bay, making it hard for planters to operate. The main fault line was between tongers and dredgers, with would-be planters fighting dredgers early on and then fighting tongers late in the Progressive Era. In Virginia, tongers and planters competed for space, but they also united against a common enemy: the dredgers. This cooperation carried over to other matters and Virginia's planters and tongers often worked together to find fair solutions to the property question.

Other states

There were small oyster fisheries in most coastal states, some of which would grow to become important in the twentieth century. North Carolina produced around 100,000 bushels in 1880, but south of that there were few oysters on the Atlantic coast, and these tended to be small "raccoon" oysters that were unmarketable. In the Gulf of Mexico, several bays had small oyster fisheries, and Louisiana's and Florida's would grow rapidly in the latter part of the Progressive Era. On the Pacific coast, San Francisco Bay had the largest oyster fishery in 1880 and Washington had an oyster fishery too.⁷⁷

2.6 Discussion: frontier ideologies in the oyster fishery

This chapter documents pre-commission management in order to understand the commissions' relationship with the fishery. Much of this early management was similar to what Judd found in Northern New England, although adapted to a very different environment. Oystermen's management practices were sensible adaptations to local bay ecology, and much like rural people in Northern New England, oystermen perceived large scale environmental decline. Although their conservation measures did not always

⁷⁷ Ibid. p188-204.

work, overall they represented reasonable, knowledgeable responses. Oystermen restricted harvesting when oysters were young and vulnerable. They restricted harvesting gear and vessels to prevent damage to the beds and to spread the harvest among more people. They prohibited the wasteful practice of gathering oysters for lime and promoted re-growth by culling small oysters and old shells. As in Judd's case, oystermen were concerned with equity and access too. Their management measures blended ethical, economic and environmental concerns.

There were also several important differences between Judd's cases and oysters. First, the oyster fishery was less isolated. Due to their poor, eroded soils and short growing season, Northern New England farmers participated less in the huge grain export trade with Europe than did the Southern and Mid-Atlantic states.⁷⁸ In the oyster case, not only was there large regional movement of resources, but there was also the exploitation of one region by another's wealthy capitalists. Railroads, and later steam ships, tied the fishery to distant markets. Continual market pressure was thus greater than in Northern New England, and to many, older communal forms of conservation seemed less tenable as the U.S.'s largest fishery struggled to cope with expanding demand.

Judd's conflicts occurred either between tourists and locals, or between older land uses and newer, more industrial ones, and the latter of these was a principal fault line in the oyster industry too. However, oystermen were more divided than Judd's New England farmers. They were divided into tongers and planters (and dredgers in the Chesapeake), but it is important not to see these as simple class divisions in the Marxist sense. Planters were often the equivalent of aquatic small farmers. Many worked a single

⁷⁸ Appleby, Joyce. 1982. Commercial farming and the 'agrarian myth' in the early republic. *Journal of American History* 68 (4): 833-849.

acre, and many favored conservation measures and that left room for tongers. Tongers also became planters. Tongers sold seed oysters to planters and the two groups depended on each other in some places. There were also dredgers, who fought with and sometimes united planters and tongers, and there were clammers, who usually sided with or replaced tongers in their fights with planters. There were also farmers who oystered as little as one day a year. Oystermen were frequently baymen who worked in other fisheries and sometimes on farms too. However, the tongers' and planters' practices did differ, and there was much conflict between these groups, which made management debates more divisive than in Judd's case.

The presence of both planters and tongers meant the fishery had two property systems. One (tonging) was more oriented toward the communal values Judd identified, and the other (planting) entailed the expansion of an agricultural frontier with its Lockean ideas about property and development. In the U.S., thinking about agricultural frontiers was tied to the Jeffersonian ideal of small farmers expanding into the wilderness, and this ideal depended on expanding markets for those farmers' crops.⁷⁹ It also rationalized the expulsion of Native Americans.⁸⁰ Thus the oyster industry featured frontier expansion side by side, literally, with communal values and practices. Planters-tonger conflict led to a spatial compromise that divided the bays and created the world's first aquaculture frontier.

The management pattern that emerged prior to 1880 prepared the ground for Progressive Era management and science. Firstly, Progressives in the new government

⁷⁹ Appleby, Joyce. 1984. *Capitalism and a new social order: The republican vision of the 1790s*. New York: New York University Press.

⁸⁰ Wallace, Anthony F.C. 1999. *Jefferson and the Indians: The tragic fate of the first Americans*. Cambridge: Belknap Press of Harvard University.

agencies developed no new conservation measures; these were all created by tingers and planters prior to 1880. The Progressive agencies would continue to apply closed season and other measures, but they added nothing new to the existing repertoire. Secondly, these measures would become more bureaucratic once management shifted to the state scale, and this depended on new knowledge production by the state, especially regarding law enforcement and property mapping. Thus in these areas, older management determined the direction of state knowledge production. Thirdly, natural science seemed more independent of the past. Scientists would use new discoveries to try to craft a management order that departed from pre-existing patterns, one that favored planters. The presence of large unused area in the bays led scientists to direct their energies to helping planters develop this frontier. The only portion of Progressive management that had little connection to past practices was sanitation, as it developed in response to growing pollution.

Chapter three: law enforcement and licensing

3.1 Introduction: surveillance and conservation

Chesapeake Bay's "oyster navies" were among the first U.S. environmental agencies. Law enforcement was integral to state conservation and oyster law enforcement required a special kind of knowledge production: surveillance. I define this type of "surveillance knowledge" as knowledge of law breaking and law abidance. Like all the chapters that follow, this chapter examines a new form of knowledge production, and its role in the shift to state-scale management, and, like the other chapters, it looks at the new agencies producing this. This shift involved the slow, sometimes painful, rationalization of punishment. By this I mean the consolidation of a claim to legitimate violence by the state, and the emergence of reliable state law enforcement.

Jacoby's *Crimes against Nature* is the most extensive treatment of fish and game law-breaking in the Progressive Era.¹ Jacoby documents a pattern where rural people broke laws because they saw laws as outside impositions that went against traditional norms and practices. Jacoby's cases are all from parks however (the Adirondacks, Yellowstone, and Grand Canyon), and so his work opens the question of how this process unfolded in different places, such as the east coast oyster industry, and if it differed, why it did so. Oystermen's response to state policing varied regionally, but these differences fell into a few patterns. In the Chesapeake Bay, local, smaller-scale oystermen welcomed increased policing because it combated the depredations of illegal dredgers and wealthy capitalists. In some parts of New Jersey and New York, local planters hired armed guards to police their own beds, and state policing supplanted this without substantially changing the local political economy. However, in both Maryland and New Jersey, corruption of

¹ Jacoby, 2001.

law enforcement officers increased resistance to oyster laws. Corruption and resource depletion by wealthy capitalists complicate Jacoby's description of rural resistance to law enforcement. In Jacoby's cases the state criminalizes local people's traditional resource use, whereas the tendency in the oyster fishery was for the state to enforce the pre-existing moral economies and political compromises. Jacoby's cases also feature exclusion of local people, and the Chesapeake oyster navies excluded wealthy outsiders who were stealing from local people.

3.2 The Chesapeake Bay oyster navies

Virginia

Virginia petitions from the 1810s complain about illegal and non-local dredging. While petitions are rare at this early date, the number rises during the 1830s, 40s and 50s, most petitions concerning oyster complain about these two related problems. This period was one of lax law enforcement because of the difficulty apprehending dredge boats (see chapter two). Much of this illegal dredging was done by northern boats. Petitioners continually asked for greater enforcement of existing laws, or stricter laws with higher punishments. They also cited tidewater communities' dependence on oysters, especially the poorer members of these communities.

The Civil War disrupted the southern trade and rested the beds, and in 1868 state legislatures established law enforcement agencies popularly known as "oyster navies" in both Virginia and Maryland. Virginia's operated under the Board of the Chesapeake. In Virginia, the main enforcement problem was illegal dredging. Boats often came from Maryland. It was illegal for Marylanders and their boats to work in Virginia waters, and

many of these boats were tongers making short trips across the border. The difficulty establishing and demarcating a boundary line with Maryland complicated this problem. Many illegal harvesters were larger dredge boats coming from Baltimore and Crisfield. There were also many illegal dredge boats from northern states. There were also Virginia dredgers operating illegally, by either working natural beds or working in counties where they did not reside, however, the most common conflicts cited in the tidewater press involved illegal dredgers from other states.

Reports of the Virginia navy's activities began to appear in the tidewater press. The *Princess Anne Herald* described how the navy, which consisted of the schooners *Tangier* and *Pocomoke* in 1868, attacked and fired upon five Maryland boats near the state line. The Marylanders were chased to the shore, whereupon they found reinforcements and returned fire.² In 1870 the *Baltimore Sun* reported the arrest of fourteen Marylanders after being fired upon by the Virginia navy. Maryland's governor interceded and these men and their boats were eventually released.³ These disputes led the chief oyster inspector of Virginia and the commander of Maryland's State Oyster Police Force to create a boundary line, which both governors approved as a temporary measure in October 1870. The governors then appointed a boundary commission in November to settle the matter permanently and thereby make law enforcement and compliance easier.

This line lessened the problem and fewer articles appeared on the navy until 1874 and "the Riggin affair." On September 11, 1874 a Virginia oyster inspector fatally shot a Maryland man (John Riggin) and arrested his four companions for illegally dredging in

² *Baltimore Sun*, November 14 and 16, 1868 (from *Princess Anne Herald*).

³ *Baltimore Sun*, June 11 and October 13, 1870.

Virginia waters. The circumstances of Riggin's death increased the outcry in Maryland. His four companions claimed the oyster inspector was guilty of "firing upon Riggin and leaving him wounded and bleeding, drifting at the mercy of the wind and the waves."⁴ The oyster inspector was prosecuted and convicted. Maryland's governor asked that the men arrested in this case not be prosecuted, but they were convicted too. A correspondence between the two governors followed that was widely reprinted in the press and seems to have been largely posturing for the newspaper audience. Maryland's governor, James Groome, stated that the boundary line was drawn too favorably for Virginia. Virginia's governor, James Kemper, replied by saying Virginia would protect its rights, and the state's Attorney General published letters saying the Maryland oyster navy was much larger and protected their side of the line much better than "the private canoe of Captain Curtis" (a reference to the Virginia navy).⁵ These cases show the difficulty and importance of rationalizing state boundary lines. Part of the problem was that the Potomac River was held in common by both states, whereas Pocomoke Sound (where Riggin died) was theoretically split between Virginia and Maryland, with most of it belonging to the former. Pocomoke Sound was a valuable oystering area. Maryland's Attorney General eventually came to Virginia and secured the four men's release, while backing down on the matter of the proper boundary. He stated Maryland had a "privilege" to fish in Virginia's part of Pocomoke Sound due to established practice, but that they did not have a legal "right" to do so.⁶ This was seen as a victory by Virginia oystermen, who wanted to exclude Marylanders.

⁴ *Baltimore Sun*, September 14, 1874.

⁵ *Baltimore Sun*, October 16, 1874. Anonymous. 1874. *Correspondence of the governor of Virginia with the governor of Maryland and the authorities of Accomac County, Va.*: Richmond: R. F. Walker.

⁶ *Ibid.*

Articles on illegal dredging in Virginia lessened after this, possibly due to decreased harvests. Over-harvesting after the Civil War led to declines in the fishery in the middle to late 1870s. Excellent sets in 1881 and 1882 helped revive the fishery, and as news of these set spread, the number of boats increased. The Virginia governor took action to protect the beds, forming a militia in late 1882. This force made a few arrests, but was a disappointment. To make a bigger impact, the governor formed a second militia in late February 1883, which had three boats, fifty men and three light artillery pieces. This second effort netted no arrests. The governor believed someone had tipped off the dredgers, allowing them to escape. He stated that the main targets were Maryland boats, although the *Baltimore Sun* reported that dredge boats from Long Island Sound were common too.⁷ In March 1883, the *Baltimore Sun* reported on another capture, by the regular oyster navy, with eight additional boats driven off by gunfire. It also estimated that at around sixty illegal boats regularly worked Virginia waters.⁸

The state transferred the oyster navy to the Board of Fisheries in 1897. In their reports, the Board regularly asked for more money, explaining that the navy was too small and slow for its task. They soon received increased funding, and by 1905, the Board was spending \$20,000 annually on its oyster patrol.⁹ Increased funding allowed them patrol the sea side for the first time, and to make an unusually high number of arrests in 1905. They also made their funding go further by borrowing boats and guns. At this point gasoline boats had just appeared in the fishery. These boats could dredge illegally and escape capture as they were faster than any of the four patrol boats. The board stated that many oystermen had volunteered to help catch illegal dredgers. In 1906

⁷ *Baltimore Sun*, March 1, 3 and 14, 1883.

⁸ *Baltimore Sun*, March 1, 1883.

⁹ Virginia State Board of Fisheries. 1907. *Report of the State Board of Fisheries*. p.3.

the legislature granted \$20,000 for a new gasoline powered patrol boat. Even with the new boats, the navy commander stated that “Great vigilance and activity are now required to inspect each individual oyster boat.”¹⁰ The Board had to visit over fifty inspectors and check as many as of the boats as possible, in addition to chasing off dredgers. The Board reported that there were attempts to sabotage the smaller police boats during this time as well. Despite this evidence of continued resistance, the oyster navy expanded its law enforcement capacity and large-scale illegal dredging ceased, which was beneficial for oystermen.

Maryland

At its inception in 1868, Maryland’s oyster navy had only one boat, the *Leila*, a dilapidated Civil War tug. In 1870 the *Leila* was repaired and twelve sloops were added to the navy. The first commander was Hunter Davidson. Many of his correspondences survive, as does his 1870 report to the Auditor of Public Accounts, and together these provide an overview of law enforcement in the new navy. Davidson reported boarding about three hundred boats in 1868 (half tongers and half dredgers). In 1870, he made eighty-eight arrests, with only fifteen acquittals.¹¹ He attributed an increase in the number of licenses taken out in 1870 to the increased number of fines levied the previous year.¹² He initiated and led the effort to survey the Maryland/Virginia line after the Riggin Affair and in his letters he said this was working fairly well.¹³ However, Davidson said the

¹⁰ Virginia State Board of Fisheries. 1906. *Report of the State Board of Fisheries*. p.1-7.

¹¹ Ibid. p20.

¹² Davidson, Hunter. 1870. *Report of the oyster resources of Maryland to the General Assembly*. Annapolis: W. Thompson.

¹³ Correspondences of Hunter Davidson, in Board of Commissioners of the State Oyster Police Force, Maryland State Papers. Scharf Collection MSA S1005. 1868-1880.

current oyster law was not working and he predicted the “early destruction” of the oyster beds as a result.¹⁴ Davidson wanted to map and buoy the natural beds, but had neither the time nor money, even though it would have aided enforcement. The other problem with enforcement was that dredgers willingly paid fines. These were too low to act as a deterrent. Many vessels were licensed under proxy owners to evade local residency requirements, and these took perhaps one third of the oyster harvest out of state. There were also too few oyster navy ships to fully enforce the law. Justices of the Peace were not well informed about the complex oyster laws and thus prosecuted unevenly. Somerset County had a law that prohibited out of county dredgers, but the county’s own beds were exhausted and they were taking out licenses in other counties, leading to armed conflict. Davidson spent much time talking to oystermen and trying to explain the law to them. The overall picture he painted is one where “the trade has run far ahead of legislation.”¹⁵

Davidson’s discussed class conflict too. He said that dredging and tonging were “two great interests...which have always been, and are likely to continue, at war.”¹⁶ He characterized it as “the rich versus the poor,” saying, “the worst of it is, that the former [dredgers] rarely lose an opportunity of impressing this fact upon the minds of the latter [tongers], by a too frequent transfer of Oysters from rich inshore beds – reserved by law for tongmen – to the holds of their own vessels.”¹⁷ He also gave a suggestive picture of the illegal dredgers. Illegal dredging had been common over the previous fifty years, and this had created a group of sailors who thought they were “masters of the Oyster

¹⁴ Davidson, 1870. p.3.

¹⁵ Ibid. p.3.

¹⁶ Ibid. p.4.

¹⁷ Ibid. p.4.

situation.”¹⁸ He stressed that they “keep much secret” to maintain their control.¹⁹ Overall, Davidson’s actions fit the moral economy of Maryland tongers. He did fine them for failing to take out licenses, but he also helped limit illegal dredging.

The Maryland archive also contains material on corruption. Several articles, written by “Licensed Tongmen,” accused Davidson of failing to do his job and insinuated that he was taking bribes. These were answered by a set of letters from “Onwards,” which was Davidson using a pseudonym. Davidson discovered that “Licensed Tongmen” was a man named Griffith, and the two exchanged private letters after this, each accusing the other. Davidson also received a letter from a man named Smith who told him Griffith was trying to become commander of the oyster navy, but withdrew when he heard Davidson was applying for the job, and furthermore, that Griffith had wanted the job to solicit bribes from dredgers. Subsequent letters (also collected in the same archive) in tidewater newspapers claimed Griffith fabricated evidence. These were written by prominent people supporting Davidson, such as a sheriff who said Griffith made up statements attributed to him. The Maryland archives contained letters from oystermen and state legislators claiming that Davidson acted in the public interest. The issue highlights the possibility of officers abusing oyster navy posts for personal gain and the contests for control of these new agencies.²⁰

Eventually Davidson would resign his position as the oyster navy appointments, including his crews and deputies, became part of the Democratic (and later Republican)

¹⁸ Ibid. p.11.

¹⁹ Ibid. p.11.

²⁰ Board of Commissioners of the State Oyster Police Force, Maryland State Papers. Scharf Collection MSA S1005. 1868-1880.

Party's patronage system.²¹ Davidson's replacement, William Timmons, was brought to court in 1873 on charges of criminal negligence.²² The case stemmed from the arrest of over thirty boats for illegal dredging that April.²³ At their May trial, Timmons said he lacked the authority to serve any of the warrants given to him, and so the cases were dismissed.²⁴ A grand jury convened and called for Timmons' removal. The grand jury also wanted a criminal collusion charge, but could not find evidence Timmons took bribes. Captain Timmons testified that dredging increased beds so an "open bay" would work better than the current laws, but he claimed to enforce the law prohibiting dredges on natural beds anyway. He also said that he had never used guns to do this, which was far-fetched, given previous and future enforcement practices. Davidson also believed dredging spread the beds and thus increased the supply of oysters, but he did not go so far as to think this was true when dredging completely wiped out beds. The Maryland archives contain letters, articles and petitions complaining that Timmons would simply sail by illegal dredgers. One letter from an oysterman asked "where is Capt Davidson who had charge last year? He is worth all together the present force and ten times more."²⁵ Despite these charges, the Board of the Chesapeake kept Timmons.

The problem of political patronage continued. An 1889 letter to the *Baltimore Sun*, which was later printed as a pamphlet titled "Maryland Oyster and His Political Enemies," characterized "the 'spoils system'" as "the 'star fish' of our Chesapeake"²⁶

²¹ Wennersten, 1981.

²² The person leading the grand jury effort was Judge Goldsborough, who would write an important definition of natural beds for oyster property mapping in 1882 (see chapter seven). Newspapers show he was clearly against Timmons.

²³ *Baltimore Sun*, April 10 and 28, 1873.

²⁴ *Baltimore Sun*, May 12, 1873.

²⁵ Board of Commissioners of the State Oyster Police Force, Maryland State Papers. Scharf Collection MSA S1005. 1868-1880.

²⁶ Cowen, John K. 1889. *The Maryland oyster and his political enemies*. Baltimore.

(star fish were highly destructive and a chief obstacle of oystermen in Long Island Sound). A history of the navy referred to appointments as “blatantly partisan,” and cited an oyster navy commander explaining in the Maryland Legislature how “the captains of these vessels should be good Republicans. Provisions might be made for putting some of the independents in as mates. It is not the right thing to buy democrats into the party.”²⁷ Another urged appointing a captain “who had contributed largely to the success of the republican ticket last year.”²⁸

Newspaper articles are a major source of information about conflicts involving the navy. The *Baltimore Sun* reported on the first arrests under the new law. Oyster navy officers were given written sworn statements of illegal dredging, witnesses showed up and corroborated this, and captains were fined. These were small boats given small fines. The *St. Michael's Comet* said the new navy seemed responsible and it “excited much interest.” It also described a gun fight between seven tonging canoes and one schooner illegally dredging in shallows off Tilghman's Island in the Choptank. The schooner was left to continue dredging.²⁹

The next year (1869) the Chester River was full of out of state dredgers due to a legislative mistake. This concerned where dredging was permitted. The law said it must be in Chesapeake Bay, and the question was where county waters ended and the bay began. Dredgers construed this to mean rivers as well, based on the idea that rivers dividing counties were state waters and did not fall under either county's jurisdiction.³⁰

²⁷ Plummer, Norman H. 1993. *Maryland's oyster navy: The first fifty years*. Chesterton: Washington University Press. p.17.

²⁸ Maryland House and Senate Documents Doc. L “Report of Commander of the Oyster Fisheries and Water Fowl” p.10, cited in Plummer 1993.

²⁹ *Baltimore Sun*, May 25, 1868 (from *St. Michael's Comet*).

³⁰ *Baltimore Sun*, February 3, 1869 (from *Centerville Observer*).

The *Baltimore Sun* reported that the Miles and Choptank River beds were being destroyed due to same interpretation of law.³¹ The state Attorney General initially upheld this interpretation. Dredgers were moving into areas they did not work before, and over-harvesting had driven down prices too. Hunter Davidson and the Board of the Chesapeake met and persuaded the Attorney General to modify his interpretation.³² This case again shows the importance of visibility and the difficulty of rationalizing political boundaries on the water.

In the 1870s, conflicts intensified, mostly likely due to growing harvests and Davidson's departure. A common example is an 1874 *Baltimore Sun* article describing St. Michael's tongers' charges that dredgers were illegally working in the Miles River for some weeks. They went to work there one morning and found them on the beds, and when the dredgers fired on them they left, armed themselves, got reinforcements and returned. They captured one boat and crew, shooting its Baltimore captain in the process.³³ Governor Whyte's 1874 address to the legislature stated that the oyster navy was under funded.³⁴ By 1876, the *Baltimore Sun* reported that dredgers were getting worse in the Eastern Bay; they moved in groups of ten to twenty, working mostly at night. There had been seven or eight arrests in the two weeks preceding this article.³⁵ A battle in early 1878 in Anne Arundel County waters led to the death of two men, forcing the oyster navy captain who shot them to resign. Their deaths led to a closed door Senate hearing the next month.³⁶ Dredgers also conspired to kill Hunter Davidson in 1871,

³¹ *Baltimore Sun*, February 3, 1869 (from *St. Michael's Comet*).

³² *Baltimore Sun*, February 13, 1869.

³³ *Baltimore Sun*, April 18, 1874.

³⁴ Plummer, 1993. p.10

³⁵ *Baltimore Sun*, January 6, 1876.

³⁶ *Baltimore Sun*, February 2, 1878.

boarding his vessel at night and sneaking to his cabin, at which point he awoke and narrowly escaped.³⁷ In general, the 1870s saw lawlessness and armed conflict between tongers and dredgers.

An article from the *Baltimore Sun* described methods of illegal harvesting. Seventy-five to one hundred ships were working in the Choptank River and Bay, “and of course violations of the law are going on.” Ships were dredging at the mouth of Little Choptank, which was illegal. Illegal dredgers worked in groups, and the closest ship dropped its peak sail when they saw a patrol approaching.³⁸ Another account described illegal dredgers working at night to avoid detection, and using lamps on the mast of a sentry boat to signal the arrival of police.³⁹ These strategies worked due to many oyster beds lying in flooded river valleys which created inlets with only one entrance.

Due to lax enforcement and high demand, in the 1880s articles started to appear expressing fear of and complaining about decline or exhaustion of the beds. For example, a *Baltimore Sun* editorial from an Oxford writer says alarm was growing among tongers worried the beds would be gone in a few years. He wrote that a few years past there were about thirty oystermen in Oxford; now there were hundreds.⁴⁰ Another typical article described the growth of tonger/dredger conflicts in the Potomac, saying oystermen wanted the state to enforce the law.⁴¹

The navy began enforcing the law more stringently after Timmons departure, although articles continued to appear discussing lack of enforcement. The main oyster navy sloop caught twenty-one boats in 1882, with twenty convictions. The commander,

³⁷ Wennersten, 1981, p.43

³⁸ *Baltimore Sun*, November 28, 1882 (from *Cambridge News*).

³⁹ Wennersten, 1981.

⁴⁰ *Baltimore Sun*, January 2, 1883.

⁴¹ *Baltimore Sun*, March 5, 1883 (from *St. Mary's Beacon*).

Waddell, used a system where his ships reported their locations by telegraph once per week to the central headquarters, which allowed him to direct and track them.⁴²

The 1880's were peak years for Maryland's oyster industry, and competition between tongers and dredgers intensified. Coupled with increased enforcement effort, this made them the most violent decade. The Cannon family of Dorchester County led a fight against the oyster navy in 1884 that was documented in the press. One of their dredge boats fired warning shot at a navy ship and then openly dredged in closed areas. They then fired on and repulsed the navy schooner, and around one hundred dredge boats began illegally dredging in the Honga River and Fishing Bay. Two local delegations went to Annapolis to ask for help. In the ensuing conflict, the navy schooner was run aground, two of her crew deserted and the rest threatened to refuse duty. The ship's captain resigned as he felt useless. The navy had to dispatch their two steamers to the area with howitzers and cannon.⁴³ In another instance, four navy ships were driven off by dredgers who waved white flags to lure them closer before attacking. They captured a fifth ship this way and threatened to kill the crew, who promptly quit. Governor Jackson described the 1880s dredger conflict as "a rebellion and nothing less."⁴⁴

Chester River dredging was the most important example. Illegal dredgers in the Chester were organized by a man named Gus Rice, who actively recruited crew members. The first arrest of these dredgers was made in 1881. However, after this it became more difficult to catch them and they began to intimidate the police. Navy officers were afraid of getting shot, or of having their ships rammed and sunk in the cold winter water. Due to the inability of the oyster police to confront the dredgers, tongers

⁴² *Baltimore Sun*, January 28, 1885.

⁴³ *Baltimore Sun*, February 2 and February 15, 1884.

⁴⁴ Plummer, 1993.

took matters into their own hands. In 1885 they built fortifications along the river banks and fired at the dredgers. This had little effect. In 1888 the oyster police finally captured one dredge boat. Local tongers set two cannon to guard over the river, but the dredgers captured these cannon. The dredgers controlled the water at this point, until Rice's flotilla fired on a passenger steamer they mistook for an oyster police boat. This sparked an outcry among Marylanders and the legislature ordered Thomas Howard, captain of the oyster navy, to end piracy in the Chester. Howard sent two sloops to battle the dredgers. The first was fired upon and sunk by the dredgers, although the crew managed to escape, and the second was captured, stripped and left to drift, and its crew made to turn the windlasses on their enemies' dredge boats for several days. Finally Howard brought the *McLane* to the scene. The *McLane* was the oyster navy's only steamer, and its iron sides and twelve inch Howitzer made it a formidable vessel. When they confronted the dredgers at night on December 10, Howard and two crew members first got in a row boat and secretly boarded two dredge boats and arrested the crew. When the alarm had been raised they went back to the *McLane* and attacked the main dredger fleet. Rice had set up a blockade of twelve ships tied together with an iron chain. The *McLane* attacked this and rammed it twice, sinking two boats, all the while exchanging gunfire with the dredgers. One man in the navy was seriously wounded. Unknown to the navy, the crews of the boats in the barricade were mostly locked below deck, and the crews of the two sunken boats drowned. Although Rice got away, this attack ended his control over the Chester. After this, conflict began to wane.⁴⁵

⁴⁵ Wennersten, 1891, p.76-82. *Baltimore Sun*, December 10 and 12, 1888. *New York Times*, November 28, December 8 and 12, 1888.

Although illegal dredging lessened, costs began to exceed tax revenue in the 1890s, and the navy had to dock a boat in 1894. They ran out of money completely in 1895 and docked all but two steamers. A 1900 inspection showed that the boats were in bad condition; their bedding was “filthy,” guns were rusty, sails and rigging “only a year old so neglected as to be very much impaired.”⁴⁶ The navy often had to borrow money from banks to stay afloat. Tongers in particular continued to make numerous complaints about lack of enforcement. Despite these continuing problems, the oyster navy slowly improved law enforcement.

Maryland oyster law enforcement history showed competing ideas about access to resources. Wealthy packers wanted open access, whereas tongers wanted illegal dredging stopped. Chester River dredgers were led by tidewater baymen though, and this division was not that neat. The tidewater moral economy was divided in a way that Jacoby’s locations were not. The oyster navies were also different than Jacoby’s cases because, when they were not undermined by the party patronage system, they supported moral economy of the rural majority.

3.3 Debates over “privilege and protection” in New Jersey

In New Jersey, competing ideas about access and exclusion flowed over into fish and game laws more generally. Articles in a rural paper in Barnegat Bay, the *New Jersey Courier*, provide evidence of this. One article titled “Are Ocean County Folks All Pirates and Criminals?” reported that “fish and game laws are broken more than all other laws put together” because the “bread and butter of the man and his family are involved.” The article went on to say the fish and game laws were making it harder to earn a living each

⁴⁶ Cited in Plummer, 1993, p.10.

year. After this it described a theme seen in Jacoby's book: rural people felt they did not need licenses to hunt for home consumption, but that this was needed for anyone who hunted for markets. The article called these persons "pothunters" and said the term was one of "the most contemptuous and approbrious expressions."⁴⁷ This article appeared as part of an exchange with New Jersey's Fish and Game Commissioner. The Commissioner agreed past laws were often "absurd and contradictory," and further stated that until recently his commission's offices were part of a political patronage system.⁴⁸ Articles sometimes referred to the beneficial role of game wardens, as was the case in an article describing them collecting over twenty-six illegal gill nets, which monopolized the catch of several fish species.⁴⁹ However, a later article complained that fish and game laws still favored city hunters, and that wealthy hunting clubs, who the article called "a nuisance," were monopolizing the best shooting points. The author pointed to a new law banning hunting on ice. By walking on ice, baymen were accessing these prime hunting locations.⁵⁰ These articles showed that Barnegat Bay residents did not want law enforcement that favored elites or took away traditional rights, but did favor law enforcement that fit their traditional moral economy by limiting monopolization.

The *New Jersey Courier* also featured a debate over "privilege" and "protection" in the 1870s. One side claimed that customary rights gave them the "privilege" to gather oysters and fish anyway they chose. Their opponents said this was depleting resources and local people needed "protection" from these depredations. A long article from April 3, 1873 is a good example. It said an earlier (missing) article had aroused agitation.

⁴⁷ *New Jersey Courier*, March 6, 1902.

⁴⁸ *New Jersey Courier*, February 27, 1902.

⁴⁹ *New Jersey Courier*, November 2, 1902.

⁵⁰ *New Jersey Courier*, January 24, 1904.

People were asking why their fishery resources were not better protected by law. The writer said when this agitation began the “privileged few” said “Let us alone! You must not take from us our rights...But they don’t have the right to take and utterly destroy that which belongs to the citizens of the whole county and state.” He then discussed summer fishing, saying about forty people “eke out...a precarious subsistence” catching the biggest fish and leaving the rest to die (it is unclear how they caught these). He also said over one hundred men who fished the bay with rods and lines were put out of work by seiners who defended their “privilege” to fish this way. “These are the *monopolists* of the bay; these are the men who prate of *privileges*” (italics in the original). The writer distinguished these from two or three large mesh seiners catching sea bass, sheepshead, and rockfish out of Lacy, Union, Stafford, who did not harm the overall fishery. His aim was to distinguish between “rights and privileges.” He said where protection had replaced privilege, fishermen and oystermen had grown rich, and cited West Creek as a model.⁵¹ Another article titled “Our Shore,” said waterfowl, fish, and oysters had all declined, and said, “[w]e claim these waters to be public domain, owned by the people of the whole state, with equal rights to all, and that in equity no man or set of men have a just right to take and destroy what belongs to the whole people.” It also pointed to West Creek’s example.⁵² Another article listed similar declines, blamed them on privilege too, and recommended a state commission to pass and enforce laws.⁵³

When oysters entered this debate, and they frequently did, writers claimed oystermen from other counties were taking away too many oysters. Delaware Bay’s wealthy planters were singled out for this. One writer compared them to drum fish, an

⁵¹ *New Jersey Courier*, April 3, 1873.

⁵² *New Jersey Courier*, December 10, 1874.

⁵³ *New Jersey Courier*, March 25, 1875.

oyster predator, and then said, “we have more formidable enemies who come upon us from adjacent counties, and who, having no interest in common with us and caring only for their own advancement, take and carry away oysters and shells promiscuously... Whilst this continues our business suffers and our people kept poor.”⁵⁴ One article said out of five hundred fishermen and oystermen in Barnegat Bay, ninety percent were honest and the other ten percent continued to destroy breeding stock. The writer said these people claimed the bay was free and needed no laws, and that these men prevented planting. Pointing to these problems the writer said, “[t]hese are the fruits of *privilege*.”⁵⁵ These articles indicate not everyone supported greater law enforcement. In this case, some local tongers and non-local planters are described as favoring less restriction and enforcement, but the general pattern suggests that most baymen in this area did favor better resource protection. These articles also suggest that people may have used the term “privilege” differently. Tongers must have felt strongly that they needed this privilege, but illegal harvesters from Delaware Bay may have just used these terms as a way to protect their businesses, which was quite lucrative in the case of some Delaware Bay planters.

3.4 Planter enforcement in New Jersey and New York

New Jersey and New York provide another example of how state law enforcement continued local people’s practices. Newspapers and commission reports from these states described planters’ efforts at self-policing. The outlines of this were described in chapter two. To recap, oystermen hired watchmen to guard their planted

⁵⁴ *New Jersey Courier*, February 20, 1874.

⁵⁵ *New Jersey Courier*, April 17, 1873.

beds. These guards were invariably armed. Newspaper articles from West Creek, New Jersey, describe the town's protective association. Planters claimed to be fighting the "Philadelphia Ring," a reference to wealthier Philadelphia packers who financed illegal dredging. The articles said every coastal town needed to "wake up and organize."⁵⁶ They went on to say if "coastal people pull together a law would be passed, but West Creek is indifferent, as they have a custom which is enforced as well as a law would be." They said their system was quick, efficient, and cheap. Only occasionally was a "surgeon required to extract out the heavy little consequence."⁵⁷ The Bridgeport association, which was formed by wealthier oystermen in 1868, also opposed Philadelphia merchants. They paid for an oyster patrol and lobbied the state legislature as well.⁵⁸

In New York, the state shellfish commission's reports mention several protective associations. For example, at Prince's Bay, the Richmond County Oyster Protective Association policed outsiders and themselves. At a large public meeting these oystermen said did not see the need for state protection.⁵⁹ Another example comes from Jamaica Bay. The Brooklyn Oyster Protective Association was founded around 1882-4, and had forty to fifty people in 1896. There was no state enforcement when it started, but by 1896 a local police chief had taken them under his wing and sent out a police boat to help.⁶⁰ These associations protected large and small planters depending on the location. These associations may have worked to exclude tongers; it is important not to romanticize these as reflecting a unified moral economy or as protecting everyone's interests. Once state

⁵⁶ *New Jersey Courier*, February 28, 1871.

⁵⁷ *New Jersey Courier*, April 3, 1873.

⁵⁸ *New Jersey Courier*, February 8, 1871.

⁵⁹ Blackford, 1885.

⁶⁰ *Fishing Gazette*, June 6, 1896.

law enforcement became the norm, there was less need for extra-legal enforcement by planters and the new enforcement followed the older pattern.

3.5 Less conflict in Connecticut and Rhode Island

Newspapers and other sources seldom mentioned law enforcement problems in Connecticut or Rhode Island. Two causes seem to account for this: deep water cultivation and the southern trade. The latter diverted illegal dredging out of Long Island Sound and the former meant that planters would operate in areas tongs never used. Less conflict meant better law abidance. In any case, the Connecticut commissioners mentioned theft occasionally, but it never reached anywhere near the seriousness that it did in the Chesapeake. The first time the Connecticut commissioners mentioned large losses due to theft was in their 1889 report. These thefts occurred in the western portion of the state, and planters combined “at great expense, for their mutual protection.”⁶¹ Fair Haven planters chartered a watch schooner. Four New York boats were seized near Stamford this year, although it is not clear who actually seized these. In 1895, the Connecticut Shellfish Commission founded a five-person oyster police and an Inspector of the Natural Beds who was also a law enforcement officer. These persons were appointed by the Commission, but the law creating this had been written and requested by the planters. The commission reports did not report on their activities, which meant there was relatively little conflict.

3.6 Discussion I: oyster law enforcement and moral economies

⁶¹ Connecticut Shellfish Commission. 1889. *Report of the Shellfish Commissioners to the State of Connecticut*. p.14.

The history of violence in the Chesapeake Bay oyster fishery is different than Jacoby's case studies where local people resist and protest state-sponsored conservation by breaking the law. This chapter shows that there were two (or more) different histories of conservation law enforcement. One of these applies to places where the state excluded local people from resources or restricted their traditional practices. These areas fit Jacoby's model. However, in the oyster case, state law enforcement agents excluded non-local, wealthier, or more industrial users whom local people could not exclude themselves.

As mentioned above, all of Jacoby's case studies involve the creation of new conservation spaces that evict local people or restrict traditional land use. What he calls the "hidden history of American conservation" is actually the U.S. version of a large international history of the backlash against park-based conservation. The literature on the backlash to international park-based conservation describes the same pattern as Jacoby.⁶² Jacoby recognizes this connection, but does not use it to define or limit the applicability of his thesis.⁶³ McEvoy documents the same pattern in California fisheries, so clearly Jacoby's model can fit fishery and other non-park resources.⁶⁴

Despite its fit with international park-based conservation and California fisheries, Jacoby's model cannot explain why local people called for greater law enforcement in the Chesapeake. The difference is due to the characteristics of the people doing the excluding and the people being excluded. The Chesapeake case fits a class of environmental problems where local people have trouble excluding others from an environmental

⁶² Neumann, Roderick P. 1998. *Imposing wilderness: Struggles over livelihood and nature preservation in Africa*. Berkeley: University of California Press.

⁶³ Jacoby, 2001. p.183.

⁶⁴ McEvoy, 1986.

commons or sink. The people they want to exclude are generally outsiders, wealthier or more powerful persons, or persons with more industrial resource use. For example, early pollution reform fits this description, as do Judd's examples of early fisheries conservation.⁶⁵ In these cases, local people were unable to exclude outsiders from a resource or stop their use of environmental sinks, but the state had the power to do this. This is why there were calls for more law enforcement in the Chesapeake; the oystermen had great difficulty excluding fleets of armed dredge boats owned by wealthy packers.

The rural moral economies Jacoby describes were more unified than those of oyster towns. In Jacoby's cases, there may be individuals who are singled out by the community for market hunting and the like, but there is a consensus about what is right, and this involves one major way of treating a given resource. In the oyster fishery, the planter/tonger division meant there were two ways of thinking about property rights, one more Lockean-liberal and one more un-propertied or communal. The point is that the moral economy could contain divergent views on property and management for a single resource, and these could lead to violent clashes within rural communities. The Chester River dredgers present a different kind of example where local communities were divided and no consensus moral economy prevailed, resulting in violence and bloodshed. Jacoby comes close to romanticizing rural violence.

Corruption is also absent from Jacoby's account of clashes with game wardens. However, corruption was crucial in both Maryland and New Jersey. Corruption highlighted the importance of who was able to mobilize state agencies to what ends. It shows the importance of not seeing the state as an actor with a predetermined agenda. In

⁶⁵ Melosi, Martin. 1981. *Garbage in the cities: Refuse, reform and the environment, 1880-1980*. College Station: Texas A & M Press.

contests over control of these new agencies, what was at stake was whether they would uphold local social relations and rights. Either way, the new law enforcement agencies were an important part of the modernization of natural resources management. They shifted the use of legitimate violence from rural people to the state.

3.7 Licensing oystermen, registering vessels, and collecting taxes

The oyster and fish commissions performed several activities closely related to policing: licensing oystermen, registering vessels, and collecting taxes. The first two of these had two purposes. One was to make oystermen more visible to law enforcement agents, the other was to make them visible for taxation. Licensing and registration increased state capacity by making oystermen visible, and by allowing for tax collection that paid for the oyster navies.

One of the first things the new commissions did was require oystermen to take out licenses. Often there was a fee attached. They were generally good for one year, and only for a specified location, which might be a town, county, or state. Oystermen had to prove residency in this location. Licenses were thus an extension of the older residency laws. Planters had to obtain licenses too, which were closely tied to leasing arrangements. Tongers sometimes protested licenses. For example, in Virginia, tongers tested the constitutionality of a new licenses tax, saying that they agreed with the need for licenses and taxes, but this one took too much of their time. The tax was based on the amount they caught, and so they had to report weekly catches to local oyster inspectors.⁶⁶ New Jersey oystermen refused to take out licenses when the state stopped a program to place shells

⁶⁶ *Peninsula Intelligence*, December 24, 1892.

on oyster beds to replenish attachment sites for young oysters (some of the license funds had been used for this).⁶⁷

Vessel registration followed a similar pattern. Commissions required all oystermen to register their vessels. Registration required proof of residency for the boat owner, captain or both. Occasionally crews had to obtain licenses based on residency as well. Vessels then had to display their registration numbers so that these would be visible to law enforcement agencies by painting the numbers on their sails or prows. Again, this practice was an extension of older residency laws.

Licenses and registrations not only helped law enforcement, they also aided taxation. Often the main tax was levied when oystermen obtained their license and registration. Taxation required enumeration, or a process that would make the oystermen visible to a central authority, and a license or registration was the perfect tool for this. Taxes varied greatly by state. Some were just enough to pay for the cost of administering the license/registration system. Maryland and Virginia used most of their taxes to fund their oyster navies. Virginia also used large oyster taxes to pay part of the Civil War debt for a few years. Rhode Island had by far the highest tax rates. Most of their burden fell on planted leases. Their Progressive Era tax revenue peaked at \$135,000 in 1913.⁶⁸ License and registration fees paid for the new state agencies. They increased capacity by funding the agencies, and they increased capacity by making law enforcement easier.

In some states there was a vigorous debate about how much to tax oystermen and what to do with this money. The Virginia case in the early 1890s is a well-documented example that shows the general contours of these debates. A Roanoke newspaper

⁶⁷ New Jersey Bureau of Shell Fisheries. 1909. *Report of the Bureau of Shell Fisheries*.

⁶⁸ Rhode Island Shell Fisheries Commission. 1914. *Annual Report of the Commissioners of Shell Fisheries*.

presented the argument in favor of increased taxation, saying “The oysters...if systematically utilized, will produce a revenue so startling in its magnitude as to cause wonder that they were not sooner controlled, and will eventually quiet concern about the baneful State debt.”⁶⁹ Governor McKinney expressed similar optimistic appraisals, saying oysters could produce one million dollars annually in tax revenue. Oysters featured prominently in the Governor’s annual addresses at this time. In 1891, they and the state debt were the two main topics and he read separate papers on them.⁷⁰ Virginia’s first fish commissioner had made similar arguments. He thought the state produced between nine and twenty million bushels of oysters annually worth near ten million dollars. He compared them to wheat, which amounted to about six million bushels annually that sold for six to ten million dollars. Virginia’s 750,000 wheat acres brought in fifty-six thousand dollars in taxes, whereas oysters were basically untaxed.⁷¹ On the other side of this debate, tidewater residents said the state debt was created to open the south and west of the state to development, and that the tidewater region was already over-taxed; they felt taxes were benefiting other regions and they were bearing an undue burden.⁷² Another common anti-tax theme was that non-tidewater residents knew little about oysters and had unrealistic ideas. A newspaper article said McKinney was “again talking oysters,” which were his “hobby,” and about which he knew nothing. It went on to say he was trying to interest inland people in oysters, but was ignoring the tidewater “on the principle of the blind leading the blind.”⁷³ Another editorial complained that

⁶⁹ *Peninsula Intelligence*, September 5, 1891.

⁷⁰ McKinney, Philip. 1892. *Special message of the Governor of Virginia to the General Assembly relative to oysters*. Richmond.

⁷¹ Marshall, McDonald. 1878. *Annual Report of the Fish Commissioner of the State of Virginia for the Year 1878*. p. 6.

⁷² *Fishing Gazette*, December 3, 1898.

⁷³ *Peninsula Intelligence*, January 7, 1893.

“mountain people” had their property and mines guarded without a special tax, and this showed that the legislature responded to them and not tidewater people.⁷⁴ This debate highlights the contest over the new state agencies and the revenue they could capture from a more legible fishery.

Only a few primary sources survive that describe tax collection and licensing. One of these is a report from the Chief Inspector of Oysters of Virginia.⁷⁵ An 1867 law created an oyster tax and three inspectors to collect it. The chief’s first act was to establish record books. Oystermen immediately petitioned him to change the law, but he felt they did this to make it easier to evade. A military order was issued approving their petition however and he had to change all his books. He only started collecting revenue in 1869. By 1870 there were 411 vessels licensed and probably 800 without licenses. Oystermen felt the military was opposed to the new law and would not enforce it, which led to their petition and defiance of collectors. The chief inspector told this to a general and he got twenty armed troops to accompany him to Tangier Sound, which led to higher collection. In Tangier and Pocomoke “there is a very general complaint” that Virginia citizens and non-residents were taking and planting oysters illegally. The ships might have licenses and local crews, but they worked for non-residents. Several were seized under this charge, but could not be prosecuted for lack of evidence and because oystermen who call for the arrests often refused to give evidence. The chief went on to say “a great deal of bad feeling has always existed between dredgers and the tongsmen.”⁷⁶

⁷⁴ *Peninsula Intelligence*, March 10, 1894.

⁷⁵ Anonymous. 1870. *Report of the Chief Inspector of Oysters of Virginia to the Auditor of Public Accounts*. Norfolk: Chas. W. Wilson & Co.

⁷⁶ *Ibid.*

Maryland has one letter book surviving from the Board of Public Works that detailed activities of the oyster navy in 1910-11 and it contained press copies of letters sent by the navy's commander, Thomas Howard. Many dealt with licensing.⁷⁷ He sent one letter to all his deputies telling them to "keep up a rigid overhauling of the tongs until all have their licenses," saying few have them now.⁷⁸ Several dealt with the deputies' conduct and lax enforcement. In one he said he had received complaints from Deal's Island that small oysters were being taken. He asked his deputy why he had not stopped this and demanded he do it.⁷⁹ Another said he was "credibly informed" almost all St. Michael's oystermen were working without licenses, and he was surprised his deputy had allowed this. He told him to make arrests.⁸⁰ Two deputies had failed to send monthly reports. One letter berated a deputy for not collecting tax from a company; this was being talked about "up and down the shore."⁸¹ A few letters were addressed to oystermen. One forceful letter requested a packer take out his licenses, and another was a form letter addressed to oystermen asking them to obey the cull laws, saying it would help prices.⁸² These cases show the ambivalence and distrust oystermen had for tax collection and licensing, and the tradition of access and exclusion licensing continued.

3.8 Discussion II: licenses and visibility

Taxes supported early oyster commissions and their conservation and management efforts; they expanded the state's capacity. Kain and Baignet note that one

⁷⁷ Letterbook of the Maryland Board of Public Works.

⁷⁸ Letter from Thomas Howard to deputies of the Maryland State Fishery Force, November 10, 1910.

⁷⁹ Letter from Thomas Howard to a deputy of the Maryland State Fishery Force, February 10, 1910.

⁸⁰ Letter from Thomas Howard to a deputy of the Maryland State Fishery Force, nd.

⁸¹ Letter from Thomas Howard to a deputy of the Maryland State Fishery Force, January 14, 1911.

⁸² Letters from Thomas Howard to oystermen, nd., and September 9, 1910.

of the major motivations for cadastral surveying was that it increased the ability of state sovereigns to tax land, and this gave them power vis-a-vi landowning gentry.⁸³ In the oyster case, registration and licensing played a similar role; they rendered people (instead of land and resources) visible and quantifiable to the state and this enabled the state to bring in revenue. Making oystermen visible expanded the state's capacity.

Licenses and registrations follow a pattern found in many commission activities. They enumerated something to make it more visible to a central authority and in doing so the commissions produced new knowledge. But knowledge of residency and illegal harvesting already existed. Oystermen could often tell if a boat belonged to a local resident or not. Vessel registration aided law enforcement officers by making this type of knowledge available to them too. Registrations and licenses also made this knowledge more objective. When an older form of knowledge had to transition to the state, it had to become more quantifiable and rational. This shift in location and form of knowledge production is central to much of the work undertaken by the state commissions.

Scott's point is that the state requires simplified knowledge about land, people, and property, and it needs simpler knowledge because that is the only way to make a complex reality legible to a central authority.⁸⁴ State knowledge thus tends to be a "thin simplification" of local knowledge. The case of oyster licenses and registrations differs from this pattern. It is hard to see vessel registration as simplifying local knowledge; although something similar is taking place, we need to use a more nuanced vocabulary. The new knowledge was more rational, more quantifiable, and less personal. Vessel registrations and licenses made the fishermen more visible to a central authority by

⁸³ Kain, Roger J. P., and Elizabeth Baigent. 1992. *The cadastral map in the service of the state*. Chicago: University of Chicago Press.

⁸⁴ Scott, 1997.

preserving local knowledge, not by overriding it. The difference between Scott's cases and the oyster industry hinges on who was guiding the knowledge production and what ideas animated the process. In Scott's cases, all the state development schemes are guided by "high modernist" planners. I will discuss this type of planning in the next chapter, but licenses and registrations were based on older residency restrictions that had nothing to do with high modernist ideals. This suggests that the process of making things visible to the state was less important than the goals guiding the knowledge production process.

Chapter 4: commissioners as legislative advisors

4.1 Introduction: the two gospels of efficiency

One of the most important tasks of the first fish and oyster commissions was advising state legislatures. The literature on Progressive Era natural resource management politics shows that there was a spilt between preservationist and conservationist ideals.¹ Conservationists were oriented toward utilitarian resource use, focusing on applying science to eliminate waste and improve efficiency, which Hays calls the “gospel of efficiency.”² All oyster commissioners’ advice was utilitarian, but there were two gospels of efficiency. Both stressed the need for more order in the fishery, but they did so in different ways. I will refer to these two views as the “high modernist” and “populist” versions of utilitarian conservation.

The high modernist commissioners fit Scott’s model. Scott defines high modernism as follows:

It is best conceived as a strong, one might even say muscle-bound, version of the self-confidence about scientific and technical progress, the expansion of production, the growing satisfaction of human needs, the mastery of nature (including human nature), and, above all, the rational design of social order commensurate with the scientific understanding of natural laws.³

Princen explains how this set of ideas applied to U.S. Progressive Era natural resource management.⁴ Progressive high modernists had a faith in rational social laws and science, and they wanted experts to use these to improve efficiency. Their fixation on efficiency led them to equate maximizing productivity with the public good.

¹ Nash, Roderick, 1967. *Wilderness and the American mind*. New Haven: Yale University Press.

² Hays, 1959.

³ Scott, 1998. p.4.

⁴ Princen, 2005.

The social laws the high modernist shellfish commissioners saw involved property and technology. They thought private property and industrial technology were more advanced, both of which were also common themes in colonialism.⁵ They also thought science would allow them to cultivate oysters in lab in a way that would greatly expand their numbers. The application of social laws and scientific advances was seen as a way to de-politicize contentious issues in the fishery. The imagined social laws made privatization and planting seem natural and inevitable, and scientific cultivation promised to end conflict by dramatically increasing production. High modernist commissioners' plans would have benefited the wealthier parts of the industry more, and scholars have noted this pattern in agricultural science as well. Agricultural historians have focused on the importance of the "organizational synthesis" or "associative state-building," in which the weakness of new state agencies forced government scientists and administrators to form entrepreneurial partnerships with private interest groups.⁶ This chapter will show how high modernist oyster commissioners fit this pattern.

At the other extreme stood "populist" commissioners. Their advice relied less on laws of society and scientific advances. Populist commissioners wanted to avoid radical change, and thought management should try to maintain many existing practices via bureaucratization. Their advice was therefore more respectful of oystermen, especially tongers, and more cautious. The populist-high modernist dichotomy is an

⁵ Drayton, Richard. 2000. *Nature's government: Science, imperial Britain, and the 'improvement' of the world*. New Haven: Yale University Press. Adas, Michael. 1989. *Machines as the measure of men: Science, technology, and ideologies of western dominance*. Ithaca: Cornell University Press.

⁶ Balogh, Brian, 1991. Re-organizing the organizational synthesis: federal-professional relations in modern America. *Studies in American Political Development* 5: 119-172. Danbom, David. 1986. The agricultural experiment station and professionalism: scientists' goals for agriculture, 1887-1910. *Agricultural History* 60 (2): 246-255. Hamilton, David. 1990. Building the associative state: The Department of Agriculture and American state building. *Agricultural History* 64 (2): 207-218. Rosenberg, Charles, 1971. Science, technology, and economic growth: The case of the agricultural experiment station scientists, 1875-1914. *Agricultural History* 45: 1-20.

oversimplification though, as some commissioners fell in between, others combined both perspectives in contradictory ways, and some were ambivalent. A dichotomy also makes it look as though these groups argued and competed, but this was rarely the case; only in Maryland is there a record of a clear debate between commissioners with these two perspectives. In general the high modernist commissioners' plans never materialized and late Progressive Era oyster management reflected the populist ideal of bureaucratizing pre-existing practices.

Both types of commissioner produced the same type of new knowledge: the first synoptic pictures of the fishery available to legislatures. In the late nineteenth century, state and federal governments sponsored many fact-finding missions and surveys. Historical geographers have studied how these surveys produced social constructions of nature and people that aided capitalist expansion.⁷ Science studies scholars have looked at how surveys involved making things more legible to a centralized authority by producing knowledge that was abstract and transportable.⁸ Both types of oyster commissioner used license and harvest data that was coming in. They both used their own investigations too; they used direct field work experience. They used statistics and field work-based descriptions to define the industry's problems, but they saw a different role for advisors such as themselves. The most radical ones argued their expertise and understanding gave them special insight, and the industry should be recast in accordance with their advice. At the other extreme, some commissioners thought highly of local practices and knowledge, and this led them to advise modifying pre-commission management by bureaucratizing it. Their techniques were similar, but their advice

⁷ Braun, 2000. Demeritt, 2001. Kirsch, 2002.

⁸ Latour, 1999.

differed. Both used statistics and fieldwork to create the first comprehensive regional pictures of the fishery, and they used this as a means of defining problems, but they did so in different ways.

The oyster case raises the question of how internal opposition and conflicting forms of co-production alter our understanding of the first knowledge state actors produced. My argument is that although they employed the same techniques, what mattered was the content of their advice. The key issue is not who spoke for the public, and the important issue was not even that these groups used new survey technology and expertise to empower themselves. The key issue was how they did this. The high modernists' way was a form of ethical simplification that focused on maximizing production to de-politicize problems. The populist way tried, at its best, to build on older norms by rationalizing them. Both used surveys and science, both collected information for a central authority and abstracted it in the process, and both empowered experts. But they did so because of the shift to the state scale of management and because of growing professional specialization. The need for bureaucratization or rationalization was a necessary part of the scalar shift as well. But this process could, and did, facilitate the maintenance of traditional practices and norms.

This chapter contains four sections. Section 4.2 provides an overview of the structure, function, and formation of the advisory commissions. Section 4.3 examines the commissioners' advice. This section is organized around themes in the advice, and generally compares both high modernist and populist versions of the same theme. Section 4.4 looks at the institutional context of the commissions. It also looks at the process of associative state-building and its relation to advising by documenting the interaction

between the commissioners' national association and industry leaders. Section 4.5 briefly describes federal data gathering, which was meant to advise legislatures too.

4.2 Overview of commission advising: structure, people, and content

Advisory commissions took several forms. Sometimes the state legislature founded special temporary commissions to investigate the oyster industry. These would tour the state and write a report presenting a picture of the industry followed by legislative advice. In other cases, the permanent state fish or oyster commissions offered advice in their annual reports. Both state and federal commissions also began compiling data in their reports. State commissions began tabulating license, registration, and tax data, and sometimes also harvest estimates. The USFC started reporting fishery statistics, and they sponsored investigations of individual fisheries, including oysters. Federal investigations and statistics were meant to guide policy, but the USFC usually stopped short of offering advice because they saw this as outside their jurisdiction. USFC scientists did express opinions sometimes though, as when one author said Connecticut's deep water planting "deserves to be classed among the most remarkable event connected with our coast fisheries" in a statistical compilation article.⁹ Beyond providing numbers, the USFC also undertook surveys that produced reports of individual fisheries. Several of these focused on oysters.¹⁰ Occasionally non-fishery agencies produced descriptive or

⁹ Collins, J.W. 1892. Statistical review of the coast fisheries of the United States. In *Report of the Commissioner of Fish and Fisheries for the year 1888*. Washington, D.C.: Government Printing Office. p.92.

¹⁰ Townsend, Charles H. 1893. Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. In *Report of the Commissioner of Fish and Fisheries for the year 1889-1891*. Washington, D.C.: Government Printing Office. Townsend, Charles H. 1896. Transplanting of eastern oysters to Willapa Bay, Washington, with notes on the native oyster industry. In *Report of the Commissioner of Fish and Fisheries for the year 1895*. Washington, D.C.: Government Printing Office. Hall, Ansley. 1894. Oyster Industries of New Jersey. In *Report of the U.S. Commissioner of Fish and*

statistical surveys, such as one done by the Bureau of Statistics of Labor and Industries of the State of New Jersey in 1883.¹¹ Statistical overviews, from all of these sources, were meant as an aid for policy makers too.

Massachusetts sponsored surveys in 1905 and 1906, which collected information to present to the legislature. The resulting reports provided a general picture of the fishery, followed by advice from the principal investigator, David Belding, the state biologist. Belding's two reports are classic statements of high modernism in oyster advising. Rhode Island and Connecticut never had special advisory commissions, but their regular shellfish commissions often gave advice in their reports.

New York carried out investigative surveys from 1884 to 1887. They were assisted by the U.S. Fish Commission, which loaned the N.Y. State Oyster Investigation Commission its steamers for short periods. Eugene Blackford was the principal investigator, although he was assisted in his first year by J.H. Rice, a USFC scientist. Blackford began in September 1884 and worked until late February 1885, and then continued surveying for six months each year again in 1885-86 and 1886-87. Blackford would later become New York's Fish Commissioner. Blackford's surveys were extensive and relatively scientific. During his surveys, he sampled bed conditions with a dredge, sent out questionnaires, and held numerous public meetings. Blackford wrote numerous reform laws, and after his final report the legislature adopted many of these. These were driven by an attempt to harmonize and clarify, and not totally replace or improve, town

Fisheries for 1892. Washington, D.C.: Government Printing Office. Stevenson, Charles H. 1894. *Oyster Industry of Maryland*. In *Bulletin of the U.S. Commission of Fish and Fisheries for 1892*. Washington, D.C.: Government Printing Office.

¹¹ Lockwood. 1883. The American oyster and the oyster industry in New Jersey. *Fifth Annual Report of the Bureau of Statistics of Labor and Industries of the State of New Jersey*. Freehold. Stainsby, William. 1902. The oyster industry: A historical sketch. In *Twenty-fifth annual report of the Bureau of Statistics of New Jersey*. Trenton: Unionist-Gazette Association, State Printers.

laws. His reports present a stark contrast with those of Belding, as Blackford was one of the more populist commissioners.

New Jersey's oyster commissions were fragmented. Not only was there a state commission, founded in 1883, but there were also district commissions with changing boundaries, a state shell commission that shelled natural beds, and a special oyster investigating commission. All four existed concurrently at one point. Lost reports are the norm for these organizations; almost all of the district and shell commission records are lost. Ideas expressed by these commissions varied greatly.

Maryland also had a special advisory commission that issued their report in 1884. This was the most lengthy and detailed report issued by any state. It appeared at the height of Maryland's oyster wars and near the peak in oyster productivity. This was a time when the oyster industry dominated Maryland's politics. The commissioners were William Brooks, James Waddell, and Henry Legg. Brooks was a professor at Johns Hopkins University and acknowledged as the U.S.'s leading authority on the oyster. He was also the leading experimenter in artificial cultivation, or growing oyster spawn in hatcheries. Waddell was an elected state representative known to favor expanding planting leases and later the head of the Maryland oyster navy. Legg was a former representative from a tidewater district and a known opponent of planting. He was appointed because he was instrumental in passing an earlier oyster law.¹² As mentioned above, they disagreed on what to do, and Brooks and Waddell fell on the high modernist side of the spectrum. The USFC also sponsored a Maryland advisory survey in 1893, which yielded the most nuanced statement of the populist position.

¹² *Baltimore Sun*, November 17, 1883.

Virginia never had an oyster commission or a commission solely devoted to advising, but their Fish Commission frequently discussed oysters, as these were the state's largest fishery. Some of their advice fell into the high modernist pattern and some did not. Their advice highlighted the ways many commissioners fell in between or combined these categories.

State legislatures formed oyster commissions for related reasons. Rhode Island and Connecticut formed commissions to rationalize their confusing lease system and thus reduce conflict in a rapidly growing planting fishery. New York and New Jersey created commissions to provide legislators information and advice. Maryland and Virginia were driven more by fear of overharvesting and increasing conflict. Oyster commissions were similar to fish and game commissions and the USFC in their formation was expected to help rationalizing management, reducing conflict, and provide information and advice for law makers.

4.3 Commissioners' advice

4.3.1 Scope of oyster decline

Both high modernist and populist commissioners agreed that oysters had declined in some areas. This varied regionally but not with the type of commissioner. In some states, especially Massachusetts, Maryland, and Virginia, commissioners thought declines would likely worsen. In Massachusetts, Belding predicted complete exhaustion of the oyster beds, saying that at present, "[a]ll hopes for the morrow are sacrificed for the clamorous demands of the present."¹³ Rhode Island first commissioner to write reports,

¹³ Belding, David. 1909. *A report on the mollusk fisheries of Massachusetts*. Boston: Wright and Potter. p.6.

John P. Knowles, complained in 1864 of the “shockingly wasteful and ruinous” practices of the fishery.¹⁴

There are two cases where commissioners disagreed on whether oysters were in danger of declining due to over-harvesting. One was in New York. The New York Fish and Game commissioners said Blackford’s first report showed Long Island beds were threatened with “ruin” due to “havoc.”¹⁵ Their article in *Forest and Stream* said Blackford blamed over-harvesting. However, Blackford never came close to predicting “ruin.” A letter from the head of the USFC to Blackford complained that the magazine had misrepresented his views on a later occasion, and this was what happened with his first report.¹⁶ This case showed that some individuals wanted his report to find evidence of decline, either for political reasons or because it fit their preconception.

The other disagreement came from Maryland’s crucial 1884 report. Brooks and Waddell claimed oysters were in grave danger of being over-harvested, but Legg said this was not so. Legg’s “minority report” claimed oysters were in fact increasing, and oysters’ natural fecundity made decline virtually impossible. He based this on increases in harvests and provided figures from Baltimore and Crisfield packing houses. Additionally, he drew a distinction between annual and permanent depletion. Oyster bars were depleted somewhat each year when they are harvested, but they then recovered. Legg said the other authors were mistaking temporary decline for a permanent condition. He described large depleted bars, and indeed whole regions of the bay, that he had seen that had recovered after a short rest. Legg’s report was unique for the Chesapeake in its claims

¹⁴ John P. Knowles. 1864. *Annual Report of the Commissioner of Shell Fisheries*. Providence. p.7.

¹⁵ *Forest and Stream*, September 20, 1884.

¹⁶ Letter from Marshall McDonald to Eugene Blackford, January 3, 1890. USFC archive, record group 22, National Archives.

that oysters were not threatened with decline.¹⁷ However, there is evidence these views were more widespread among oystermen.¹⁸

Following his notion of temporary decline, he felt the beds needed rest and protection. However, despite saying protection was needed, he believed the state did not need a “large and cumbersome navy,” nor “high-salaried commanders and crew.”¹⁹ The Maryland oyster navy was then mainly a political appointment and did little to protect oysters, so this was an understandable position, except that Legg would later run for oyster navy commander.

Legg’s advice was also puzzling given that the *Baltimore Sun* reported oystermen in at least one location told Legg oysters had declined and immediate action was needed.²⁰ When Legg sent out circulars, and his first question was, “What causes in your county have so reduced the supply of oysters?” The *Baltimore Sun* reported that the main answers to these were illegal dredging and overworking beds.²¹ Legg was a candidate to represent Queen Anne County at this time and he told the paper oystermen would only find friends in the democratic party (his own).²² He was adopting views that were politically expedient. Saying that there was no problem allowed him to reject Brooks and Waddell’s recommendations and position himself as the tongers’ ally. Legg’s case is also important because it illustrates the diversity of the populist commissioners’ views and motivations.

¹⁷ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*.

¹⁸ Keiner, 2001.

¹⁹ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.138.

²⁰ *Baltimore Sun*, October 22, 1883.

²¹ *Baltimore Sun*, November 17, 1883.

²² *Baltimore Sun*, October 22, 1883.

The 1884 Maryland report is also useful for understanding how the threat of immanent decline shaped high modernist recommendations. It is impossible to understand the high modernist commissioners' view without understanding their moment in time. Brooks warned about impending collapse in his 1884 report to the Maryland legislature and he was correct in judging Maryland's 1880s harvest levels as unsustainable. These were the state's peak harvest years and modern biologists have confirmed that this level of harvesting could not have gone on for long.²³ It is important to see the reasonableness of Brooks' fears. It is easy to criticize the commissioners' high modernist plans that follow, but it is important to see the impulses behind them. This was a time period when many smaller oyster beds had already been depleted and much over-harvesting was taking place. Oysters were still the most important fishery in these states though. The importance of the fishery, combined with local declines and over-harvesting led many commissioners to feel rapid, drastic action was the only remedy. It is hard to overstate how grave the problem seemed to them. They saw rampant destruction and regular violence. Their dire predictions were more than leverage for funding and intervention. They were reasonable, sober assessments of the situation by people who wanted to advance the public good. This was a time period that saw the loss of the bison (almost) and the passenger pigeon. To understand Progressive high modernism, one must recapture their sense of being on the edge of a cliff.

4.3.2 Rationalizing old oyster laws

In all states commissioners agreed that inadequateness of existing laws and their enforcement was one of the fishery's main problems. Belding said existing shellfish laws

²³ MacKenzie, 1996.

were “the first evil which demands attention.”²⁴ Rhode Island’s commissioner Knowles described laws as “incongruous, inconsistent, and, I will add, suicidal.”²⁵ Knowles thought the laws had contradictory provisions attempting to reconcile different interests. Maryland’s second fish commission report explained that “much previous legislation has been ineffective, as based on evidence defective and misleading in character, the result of misstatement and convictions found by conflicting advice given by interested persons and by those guided by too imperfect observations.”²⁶ In Virginia, the commissioners stated that the laws were “partial, imperfect, confused, and inoperative.”²⁷ Both high modernist and populist commissioners wanted to improve old laws, but they differed greatly on how to do this. This section presents populist commissioners’ advice on how to improve older oyster laws.

In New York, Blackford’s reports provide detailed descriptions of how the legislature should rationalize older laws. First, he felt laws needed greater clarity to settle disputes. In particular, he wanted them to clarify the limits of town versus state jurisdiction, a persistent problem for New York State. The legislature also needed to needed to legalize many common law provisions and harmonize laws, such as closed seasons, across the state. The recommendation to streamline or harmonize laws was the most common feature of populist reports.²⁸

Blackford cautioned against standardizing all management measures however, because of variation in environmental conditions. His comments highlight another key

²⁴ Belding, 1909. p.5.

²⁵ Knowles, 1864. p.5.

²⁶ Ferguson, 1881. *Report of T.B. Ferguson, a Commissioner of Fisheries of Maryland*. Hagerstown: Bell. p.cxiv.

²⁷ Virginia Fish Commission. 1878. *Annual Reports of the Fish Commissioners of the State of Virginia for the Years 1875-6 and 1876-7*.

²⁸ Blackford, Eugene. 1886. Second report of the oyster investigations and survey of the oyster territories: 1885-1886. In *New York State Fisheries Commission Second Annual Report*.

theme of populist advising: the importance of maintaining local management. In Connecticut, the commissioners wrote that towns-managed oyster beds were “so numerous, and so different in character and environment from the deep water beds and from each other, that uniform laws of regulation might work more harm than good; and each town is the proper judge of what is best for its own oyster-beds.”²⁹ New Jersey’s state oyster commission advocated keeping district commissions for the same reason, saying, “we regard it as absolutely essential to the welfare of the industry that agents of the state...must be upon the grounds to give proper attention to the industry.”³⁰ This openness to local management shows that the populist commissioners saw value in allowing oystermen more say in management (as opposed to centralized state management), and they were more comfortable with locally specific statutes (as opposed to ones written solely by state experts).

Another important aspect of the populist reports is that they sometimes express uncertainty. Connecticut’s early shellfish commissioners felt they needed the power to hold hearings and make people testify to “establish order where disorder and confusion now exist.”³¹ The commissioners acknowledged that there were numerous opinions on what to do to protect natural beds, which made it hard for them to know what was best. They did recommend stirring up the oysters to clean them just before spawning, and then having a closed season when they spawn. But since the best ways or times to do these were still uncertain, they hesitated to recommend changes in the law. Acknowledgement of limits of their knowledge was uncommon among high modernist commissioners.

²⁹ Connecticut Shellfish Commission. 1882. *Annual Report of the Shellfish Commissioners to the State of Connecticut*. p.73.

³⁰ New Jersey Bureau of Shell Fisheries. 1912. *Report of the Bureau of Shell Fisheries*. p.25-26.

³¹ Connecticut Shellfish Commission. 1882. *Annual Report of the Shellfish Commissioners to the State of Connecticut*. p.53.

Mapping and enforcement were key themes in rationalizing advice from populist commissioners. New Jersey's state commission provided a good.³² They started by touring the state to better assess conditions in 1884, gathering statistics and holding public meetings as they went. Their main conclusion was that planting was limited because natural beds were not mapped. Lack of maps led to constant litigation and disputes between planters and tongers. Their main recommendation was to designate and map boundaries, although they thought this would be prohibitively expensive. Their second recommendation was better protection. They recommended a police steamer for this. In other words, they recommended mapping and police as means of clarifying and enforcing older laws.

Virginia's fish commission also frequently recommended better policing. The first time they mentioned oysters (1876-7) it was to say that they needed a larger navy, as they feared Maryland's would drive "that lawless class" into Virginia waters.³³ Virginia commissioners seldom mentioned threats to oysters, but in other fisheries they blamed dams, pollution, fixed nets and wasteful practices such as high-grading and avoided simplistic causes in their explanations.³⁴ Much of their advice on the oyster fishery centered on the confusion created by "voluminous and complicated" laws.³⁵ Their main advice was to streamline these. They made many small specific recommendations, such as harmonizing Virginia's and Maryland's season opening dates. The commission felt barren areas designated as natural beds should be leased, but stopped short of calling for complete privatization. The reports in this period also began collecting statistics gathered

³² New Jersey Oyster Commission. 1884. *Report of the Oyster Commission*. p.17.

³³ Virginia Fish Commission. 1878. *Annual Reports of the Fish Commissioners of the State of Virginia for the Years 1875-6 and 1876-7*. p.61.

³⁴ *Ibid.* p.33.

³⁵ Virginia Board of Fisheries. 1902. *Report of the Board of Fisheries*. p.1.

by the inspectors and relaying these to the legislature. The commission claimed that most of the industry supported the new, more streamlined, laws and wanted a “just, favorable and final solution of a much vexed question.”³⁶ Despite these recent changes, the laws still had “confused, and sometimes unintelligible provisions...contradictory statements...so many exception and qualifications, and special and local statues” as to make enforcement and public understanding difficult.³⁷ The commission said they were overwhelmed by requests for information on laws.

The Virginia commission not only advised; like Blackford they wrote bills which they sent to the legislature. For instance, they wrote a bill to change lease laws in the James River that failed to pass by one vote in 1907. They also submitted a bill to simplify the existing oyster laws without actually changing them, which also failed. Its forty-eight page bulk gives a sense of the profusion of Virginia oyster laws. They also recommended several steps to solidify their position. They had no office at the start of this period, and so they asked for one. Oyster law offenders often rapidly retained counsel and local sentiments tended to sway judges, so commission members often had to appear in court too, occasionally having to hire attorneys, so they asked the legislature to hire a permanent attorney for them.

Commissioners frequently carried out surveys where they asked oystermen their opinions about how to improve older laws. None of these survive, but newspapers do sometimes discuss this. Tidewater papers frequently commented on the results of Legg’s survey in the spring of 1883. Legg claimed much depended on the quality of information the commission received from oystermen, and as he traveled he asked for information on

³⁶ Virginia Board of Fisheries. 1906. *Report of the Board of Fisheries*. p.20.

³⁷ Virginia Board of Fisheries. 1907. *Report of the Board of Fisheries*. p.6.

access law, summer planting, condition of the natural beds, defects in the law, possible remedies, local versus outsider law violation, and the timing and extent of catch.³⁸ Legg wrote an article for the *Easton Ledger* on St. Michael's oystermen's opinions, claiming they asked for no planting in the closed season, no home consumption taking in closed season, starting the closed season June 1st, and banning scrapes.³⁹

Overall, populist commissioners wanted to bureaucratize tradition. The commissioners were producing new knowledge: the first synoptic picture of the fishery for legislatures. They were using this to argue for ways to maintain traditions based on long held, widespread norms. To do this fishery law and management had to be rationalized in the same way enforcement had; they applied that basic pattern to property, cull laws, closed seasons, and similar provisions found in older laws.

4.3.3 Property

High modernist commissioners also wanted to change existing laws, but in very different ways. The main defect they singled was the way common law prevented planters from encroaching on tongers' oyster beds. These commissioners also saw past laws as overly complicated and contradictory, but to them, restrictions on planting were the fishery's chief problem. This single root cause led to a single solution: privatization. I use the term privatization to refer to a range of propositions however, as some commissioners recommended outright fee simple ownership of underwater land, whereas other only wanted expanded state leases. All wanted expanded planting, which required

³⁸ *Baltimore Sun*, June 18, 1883 (from *Easton Ledger*).

³⁹ *Baltimore Sun*, September 22, 1883 (from *Easton Ledger*). Scrapes were small dredges used mainly in the Chesapeake Bay oyster fishery. In the *Easton Ledger* article, oystermen attributed recent losses to the use of these devices.

greater security for the planters, and the term privatization carries a connotation of enclosure that fit the thrust of their argument.

Belding's description of the Massachusetts oyster fishery is a good example of this view. He began his first report by saying,

The first difficulty confronting this proposed system [privatization] is the too frequently accepted fallacy that all lands between the tide marks now are and should be held in common by the inhabitants of the shore communities, to the exclusion of citizens from other sections of the State.⁴⁰

He blamed oyster decline on "the disastrous effect of this policy."⁴¹ The next step was to describe the link between private property and progress. This was always expressed in law-like terms. Commissioners described these supposed social laws as obvious to any unprejudiced, objective person. Belding's first discussion of common property puts it this way:

[T]his fallacious assumption is contrary to the fundamental principles of all economic doctrines. It may be safely assumed that the individual ownership of property...is a necessary condition of progress, and has in fact at length become the foundation of all society.⁴²

Privatization was thus the only practical system for halting decline. Private leases would allow natural laws to function smoothly, as "[i]n all business individual initiative and effort furnish the keynote of success."⁴³

Expanded planting or privatization was seen as the obvious best solution for the fishery's problems. Belding proposed that the state should lease most areas to individuals close to shore in small lots and to individuals or companies farther from shore in plots of unlimited size. He did say public property should also remain in every township however.

⁴⁰ Belding, 1909. p.5.

⁴¹ Ibid. p.5.

⁴² Ibid. p.5.

⁴³ Ibid. p.8.

It is not clear why he recommended preserving any public property at all, but his comments are an example of how high modernist commissioners often express divergent views. High modernist commissioners usually wanted surveys and enforcement to delineate and protect planting areas too.

High modernist commissioners' views ranged from favoring true and total privatization of all underwater property to the more moderate stance that leasing needed to expand. In Maryland, Brooks and Waddell felt leases should come with perpetual title. Perpetual leases were an unusual and extreme recommendation, but even more controversial was their stance on natural beds. Since almost any place in the Chesapeake Bay contained a few oysters, oystermen could and did claim almost the whole bay as a natural bed, which by common law prevented the establishment of private property. Therefore, Brooks and Waddell felt the whole Bay should be "thrown open to private cultivators."⁴⁴ If public sentiment was against this, which it was, then he wanted surveys to delineate "legally regarded natural beds" as soon as possible.⁴⁵ They noted that it would be extremely difficult to map natural beds, especially now that they have been spread out by dredging. They pointed out the difficulty Connecticut had had mapping their beds, which were much smaller and more contained. Brooks and Waddell took an extreme position.

These commissioners were well aware of their critics. Legg's Maryland report stated that natural beds must be "held as a great commons...not sold to a few capitalists, thereby making the rich richer and the poor poorer,"⁴⁶ and his views were widely shared by tongers who depended on common property areas. Belding acknowledged that

⁴⁴ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.133.

⁴⁵ Ibid. p.131.

⁴⁶ Ibid. p.139.

monopolization was a potential problem with privatization. Brooks and Waddell in Maryland also identified monopolies as the chief problem. Belding thought leases would need to be non-transferable to prevent speculation and monopoly, and there would have to be provisions for the poor so they could acquire leases too.⁴⁷ Brooks and Waddell said the state could handle this problem by granting anyone their own farm, and by retaining the law limiting planting leases to five acres.

Stevenson's 1893 Maryland report shows that he was the only government employee to publicly oppose opening natural beds to planting in the early Maryland oyster debates.⁴⁸ His views are thus important to look at in depth because they show the range of opinions seen in the early commissions, and because they express faith in local practices. Stevenson began by explaining the uniqueness of Maryland's oyster fishery: he stated that it was by 1890 producing far more oysters than all the other countries in the world combined, and it was "[b]y far the principal means of support" in the eleven tidewater counties.⁴⁹ It was the one state that had "persistently refused to encourage an extensive development of private oyster fisheries, devoting instead all its energies toward conserving and protecting the free fishery on the public domain."⁵⁰ Instead of complaining that this was the basis for problems in Maryland's fishery, he thought this should be a source of pride and the continued basis for management. His views, although uncommon in the Maryland debate, were one way the populist commissioners responded to arguments blaming common property.

⁴⁷ Ibid. p.13.

⁴⁸ Keiner, 2001. p.64.

⁴⁹ Stevenson, Charles H. 1894. Oyster industry of Maryland. In *Bulletin of the U.S. Commission of Fish and Fisheries for 1892*. Washington, D.C.: Government Printing Office. p.205.

⁵⁰ Ibid. p.205.

Connecticut commissioners in the late 1880s argued against expanding leasing too. They said that many oystermen had over-extended their holdings; they shelled too much ground and could not protect them from starfish. They blamed this practice for increasing starfish, saying “The oystermen must give up their notions of large crops growing without care or labor. They must confine themselves to areas which they can manage and protect.”⁵¹ Much of the cultivated areas are “left without attention” leading to starfish growth.⁵²

It is important to see why high modernist planners thought as they did. Privatization was appealing in part because it was a single solution to a complex problem. McEvoy, discussing Progressive Era fishery management in California, found a similar pattern, and noted that privatization “was government’s way of collecting a wide range of interrelated problems under a single relatively manipulable legal abstraction.”⁵³ Privatization was the lynchpin of the more radical reforms because it promised to do so much with so little.

4.3.4 Collective action problems

Tied to the discussion of common property was a theme about collective action problems. In general, commissioners who developed this theme blamed collective action problems for decline of the fishery. Collective action problems were situations where the individual’s short term interests led them to act in ways that harmed the group’s long term interests. As Belding explained, “[t]houghtful fishermen,” who would otherwise

⁵¹ Connecticut Fish Commission. 1881. *Annual Report of the Commissioners of Fisheries of the State of Connecticut*. p.21.

⁵² Ibid. p.22.

⁵³ McEvoy, 1986. p.118.

control the fishery, were forced to overfish, realizing they might as well get their share before the fishery was exhausted.⁵⁴ This theme fit Hardin's "tragedy of the commons" model.⁵⁵ The tragedy of the commons appealed to high modernist planners because it gave a law-like explanation for over-harvesting, and it provided a simple solution: private property would create incentives that would make the fishery more efficient and productive. However, commissioners, particularly populist ones, developed this theme in complex and sometimes contradictory ways.

The Connecticut commissioners, who were generally populist, provide a good example. In their early reports, they said public beds that were "free to all" were "quickly despoiled by reckless fishing."⁵⁶ They made the same error as Hardin in mistaking common property for open access (or at least being vague about which they meant). They cited depletion of natural beds in Europe, the Chesapeake, New Jersey, and New York as examples of this process. Their case was one where populist commissioners adopted a high modernist theme.

The same commissioners' ideas about collective action problems can be seen in 1884, when their report discussed tongers' character. Planters were blaming them for starfish infestations. Tongers were not killing them whenever they found them, and thus a population of starfish built up around the natural beds, and these then attacked the planters' oysters, according to this theory. The commissioners agreed, explaining that

The avarice of today blinds them [the tongers] to the prospects of tomorrow... The Commissioners would not want to give the impression that all men who work upon the natural beds are open to these charges... The Commissioners have found them, with few exceptions, honest, industrious and well disposed. No one can be

⁵⁴ Belding, 1909. p.5-6.

⁵⁵ Hardin, Garrett. 1968. The tragedy of the commons. *Science* 162: 1243-1248.

⁵⁶ Connecticut Shellfish Commission. 1882. *Annual Report of the Shellfish Commissioners to the State of Connecticut*. p.44.

reasonably blamed for omitting to do that which is the joint duty of all – for failing to cooperate when cooperation is impossible. If public beds, therefore, are to be kept clear of stars, it must be done in some other way than by the voluntary efforts of oystermen.⁵⁷

Although it did accuse tongers of “avarice,” this view placed blame on the difficulty of collective action, rather than on the oystermen’s character, for their inability to kill starfish. This was the more common way populist commissioners used the theme of collective action problems: problems in the fishery were often caused or made worse by the dynamics of individual incentives.

The New Jersey commission applied this reasoning to the state’s cull law. They began by saying the law had helped arrest the decline in seed oysters. However, these gains were soon reversed by “[t]he greed of the tonger, prompting him to take everything, so that he may lose nothing.”⁵⁸ The cull law was hard to enforce and oystermen evaded it by saying they had not thrown the shells back yet but intended to do so and the commission said the law had become ineffective. They recommended revising the law so that tongers could only catch a certain amount before culling. They claimed this would meet with “universal approval” from oystermen.⁵⁹ They felt tongers only disobeyed the law because they were sure everyone else was doing the same, due its being so easy to evade. The commission also disliked the law allowing anyone to harvest two bushels without a license, saying it “is simply a legalized nuisance...[and] an excuse for shirking the law altogether.”⁶⁰ This shows some of the ambivalence of the populist commissioners.

⁵⁷ Connecticut Shellfish Commission . 1884. *Annual Report of the Shellfish Commissioners to the State of Connecticut* p.13

⁵⁸ New Jersey Bureau of Shell Fisheries. 1904. *Report of Shell Fisheries*. p.59.

⁵⁹ Ibid. p.60.

⁶⁰ Ibid. p.60.

Commissioners in other states often analyzed cull law problems this way. Stevenson repeatedly said the cull law was the most useful conservation tool Maryland had, but, unlike the also useful closed season, no one obeyed it. The reason was that tongers could get twenty cents a bushel for undersized oysters and these were recently legal. The cull law was also hard to enforce. He described the history of the law, providing a letter from Joseph Seth (commander of the Maryland oyster navy), explaining a problem with the past law. The navy was to search vessels and enforce the law by dumping one barrel out of fifty on deck and making them cull it. Anything below the legal limit could not be sold, but did not have to be thrown back if they were already off the bed where it was caught. These unsellable oysters were given free to the packers. Because of this, Seth said, “I find all classes to agree with me in saying that the cull law should be vigorously enforced, and all as unanimous in both violating it and trying to screen violators from arrest by the fishery force.”⁶¹ The law was improved the following year, and this highlighted the slow evolution of the cull law. Stevenson included information on the slow improvement of other laws to show how the cull law had advanced. The important point again is to see how Stevenson, and Seth, explained the problem with the cull law as a collective action dilemma created by the discrepancy between individual and group incentives. As with the Connecticut commissioners, they proposed rationalizing older conservation mechanisms to fix this problem, and they all claimed tongers wanted the state to do this for them.

Stevenson and other populist commissioners sometimes applied collective action analysis to over-harvesting on natural beds as well. Stevenson said Maryland was divided between two “great interest:” tongers and dredgers, who “wage war unitedly on the

⁶¹ Seth quoted in Stevenson, 1894. p.213.

planters.”⁶² After rejecting arguments that tongers’ character was to blame for over-harvesting, he cited a collective action problem as the main issue, saying

The great trouble with the present methods and regulations is not with the close seasons or with the implements employed, but, as in other States, the oystermen take no individual interest in the preservation and development of the reefs on which they work, their sole object being to obtain at the moment all the oysters possible, without reference to the future supply. Individual interests clash with the public good. While it is the public or general interest of all that each oysterman should refrain from taking the small and poor oysters, taking few during bad markets, and give attention to removing enemies and leaving the reefs in the best condition for further reproduction and growth, it is his individual but temporary interest to take all he can get, big and little, fat and poor, in good markets and in bad markets, and with the least possible expenditure of time. As with other men, the individual gain of to-day outweighs the public good of tomorrow.⁶³

Ideally, tongers would prepare beds and be careful to protect the small oysters, but these measures were unlikely in a large “public domain.”⁶⁴ It is important to note that Stevenson, along with Blackford, was the most outspoken and articulate populist commissioner. Even he saw collective action incentives as a real problem. This explanation for decline was so common because it contained a strong element of truth, and because it fit so many agendas well. High modernists used it to argue for privatization, and populists used it to argue for rationalizing and building on traditions that could help overcome these incentive problems.

4.3.5 Historical narratives and comparisons

High modernist commissioners often described common property and the oyster problem within a larger historical narrative. This followed the pattern Drayton describes

⁶² Stevenson, 1894. p.206.

⁶³ Ibid. p.289.

⁶⁴ Ibid. p.290.

as the colonial narrative seeing enclosure as improvement.⁶⁵ This posited an inexorable progression from common to private property, and it saw this shift as both an engine of and prerequisite for improvement. It was expressed as a self-evident social law. For proof, commissioners cited numerous and diverse examples. Commissioners used surveys to make nature and the fishery visible, and they also used them to make the social laws visible by reporting on how enclosure correlated with improved conditions. They claimed to be laying bare the fundamental operative principles of the fishery and advised legislatures to base their laws on them.

The high modernist commissioners argued there was one right answer (privatization) that could claim objectivity in accordance with social laws. In doing so, they hoped to substitute objective laws for political arguments. This advice also simplified ethics; it narrowed the goal to maximizing a single variable (i.e., productivity). This was the ethical argument of the “Taylorist” side of Progressive Era reforms, and much Progressive natural resource management, from agricultural extension work to federal forestry, had a strong Taylorist bent.⁶⁶ It appealed because it promised to identify a lynchpin. For oysters, this was a supposed social law that showed privatization was the one right way to arrange social relations and rights. Such laws seemed powerful because they revealed root causes, and thus the one fundamental change needed for progress. This thinking lead to greater optimism and appetite for radical change.

It is important to understand why so many commissioners saw things this way. The calm in Connecticut’s planting fishery when compared to the chaos in Maryland’s almost entirely non-planting fishery was one reason. Connecticut’s planting fishery was

⁶⁵ Drayton, 2000.

⁶⁶ Princen, 2005.

more capital-intensive and industrial fishery too (see figure 4.1 for a picture of a large Connecticut planting steamship). More important though was the sense of crisis and potential mixed together. They saw themselves, quite reasonably, at a turning point. They saw themselves faced with the prospect of steep declines in the future, but if they could only make people see the fundamental principles of enlightened management, they could be on the cusp of a much more prosperous era. It was this combination that made the high modernist call so seductive.

New Jersey commissioners' advice on leasing barren natural beds illustrates the way commissioners saw progress as objectively rational. The commissioners expressed incredulity toward the current policy prohibiting leasing in these areas, saying it "can hardly be conceived" and it "seems beyond comprehension" that people could not cultivate barren former beds. They acknowledge that doing so "would cause such a howl of wrath... Yet it is really difficult to see why any can with good reason object."⁶⁷ They cite the objectivity of their argument, saying "[i]t would really seem that such a measure in oyster farming should require no argument to prove its desirability, on the principle universally accepted the world over."⁶⁸ This quote captures an important element of high modernist advice: casting traditional norms and practices as backwards, and offering law-like principles for objectively guiding progress. The New Jersey commissioners thought opposition to planting on defunct natural beds came from tongs not wanting to see someone else do well, even if it did no harm to themselves. Their 1901 report also mentioned that Virginia, Maryland and Connecticut all leased "non-productive bottom," which was misleading. At this point Connecticut did do this, but only after examination

⁶⁷ New Jersey State Oyster Commission. 1901. *Annual Report of the New Jersey State Oyster Commission*. p.21-22.

⁶⁸ Ibid. p.23.

and public hearings, while Virginia and Maryland did not lease non-productive areas designated as natural beds. It is unclear if this was an error or an attempt to mislead the legislature. The commissioners had taken a trip to Connecticut a year before, so this may have influenced their report. Another influential factor was their perception that oysters propagated and fattened better in different locations. This meant some areas were better for growing seed than others, and these tended to be areas designated as natural beds.

Belding again provided an articulate version of this perspective. He couched the need for privatization in a history of Massachusetts resource and property law. He said Massachusetts' Great Pond Ordinance sanctioning public access to the waters was just at the time, but only because the population was small in the 1600s. However, in the 1900s "[t]his communistic system is distinctly unsound, and is in direct opposition to the principles of social and economic development."⁶⁹ Belding also made a comparison to farming, as did many other commissioners. He said oyster commons were the equivalent of leaving farmland unplowed so people could pick blackberries in common, a practice which revealed practitioners to be "mentally unbalanced."⁷⁰ Belding used farming metaphors to temper his denunciation of common property though. Other shellfish beds were like wild meadows, but oyster beds were like gardens. They needed to be tended, which was why oysters needed places under private ownership. Other shellfish did not tending, so they could be managed under common property.⁷¹

Frontier analogies were a staple of high modernist advising. Knowles provided a classic example of using the history of frontier settlement in a law-like fashion that linked private property to progress:

⁶⁹ Belding, 1909. p.5

⁷⁰ Ibid. p.6.

⁷¹ Ibid. p.132.

A sale of the wild lands of the Federal Government to emigrants, that the wilderness may blossom as the rose, with the arts, institutions and structures of New England civilization, no statesman ever yet opposed, on the grounds that the trappers, hunters and squatters, accustomed to scour those lands for game and plunder, might complain of infraction of their natural rights, and expulsion from the “free and common” hunting grounds, where, perchance, the fathers and grand fathers vegetated in poverty and semi-barbarism, - and, worse than all, trained up their offspring, only to fill their fathers’ places.⁷²

Oyster planting did create an aquacultural frontier, and commissioners knew this and this added force to this type of analogy.

Populist commissioners rarely discussed progress in a law like fashion. Blackford provides an interesting example of the populist take on the inevitability and desirability of expanded planting. He did hold up Connecticut as a model that New York should emulate, saying “All the leading oyster experts of the country strongly recommend the system.”⁷³ But he also wanted to carefully maintain natural beds “as seed nurseries” tended by local tongers.⁷⁴ When he discussed the decline of natural beds he said “It can readily be seen from this that the oyster industry is rapidly passing from the hands of the fisherman to those of the planter and oyster culturist.”⁷⁵ But he saw this in a nuanced way, explaining that this was both “good and bad.” It was good in that planted beds produced more oysters, but it was bad because tongers were not compensated for their loss and seed supply diminished. Blackford’s views thus stood at an opposite extreme to the views of Belding and Knowles.

4.3.6 Role of science

⁷² Knowles, 1864. p.7.

⁷³ Blackford, 1886. p.7.

⁷⁴ Ibid. p.6.

⁷⁵ Ibid. p.5.

Brooks added an influential dimension to this theme, one that linked social laws, property, and science. He and Waddell saw “over-dredging and unwholesome laws” as major causes of oyster decline in Maryland.⁷⁶ Local laws contained “the greatest confusion and conflict in the statutes.”⁷⁷ Brooks “procured a coast survey chart and tried to trace on it the requirements of the different local laws, but found the legal boundaries overlapped in labyrinthine confusion.”⁷⁸ They recommended districting the bay and limiting dredging.⁷⁹ Brooks in particular believed dredging would soon wipe out beds, but he thought a larger navy would not help much.

Instead of improving laws and enforcement, Brooks and Waddell introduced a new theme, saying “the supply of oysters must be artificially increased, for the natural fertility of the oysters is not great enough to withstand even the present drain upon them, and the demand for oysters will certainly increase from year to year.”⁸⁰ Although they cited “unwholesome laws” as a cause of decline, they stated that better laws would only provide a “temporary improvement.”⁸¹ They then recommended a whole list of legal improvements: banning dredging in the Potomac River and its tributaries, getting rid of local laws to regulate the fishery, simplify boundaries of dredging areas, creating districts for a system of rolling closures, adding more police boats, banning burning shells for lime, and culling of all catches on site. They discussed the pros and cons of each of these in detail. Each would “help to arrest the destruction” of the beds, but they would not be “of any permanent value,” as increasing demand would swamp these improvements.⁸²

⁷⁶ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.2.

⁷⁷ *Baltimore Sun*, October 24, 1883.

⁷⁸ *Ibid.*

⁷⁹ *Baltimore Sun*, October 14, 1883.

⁸⁰ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.3.

⁸¹ *Ibid.* p.3.

⁸² *Ibid.* p.8.

Brooks made the same argument in his book, *The Oyster*, which was a popular treatment of the oyster problem. In it he wrote the principal cause of decline was that “THE DEMAND HAS OUTGROWN THE NATURAL SUPPLY” (capitals in original).⁸³ Brooks and Waddell felt their surveys, when compared to an earlier survey by Winslow, “justify the worst foreboding,” saying the oyster beds were in “imminent danger of complete destruction” due to increasing demand.⁸⁴

There was a great deal of truth to this of course. What made it a high modernist theme was the way Brooks, who was also the leading U.S.’s oyster scientist, linked science and property. After explaining how science must increase productivity, Brooks and Waddell immediately explained that cultivators had to place hatchery grown oysters on private leases, not public beds. They said that “[t]he only obstacle [to scientific production methods]...is the existence of the sentiment that since the oyster grounds belong to the whole people, they are not the proper field for labor and industry.”⁸⁵ The authors were sure the newer cultivation methods would require private property because no one would invest in improving common property. Most fisheries were commons because people could not improve them, they said, but this would soon no longer hold true for oysters. They went on to compare oysters to farming potatoes, and equated privatization with the “progress of civilization.”⁸⁶ They continue this motif throughout their 1884 report saying,

Civilized races have long recognized the fact that the true remedy is not to decrease demand, but to increase the supply of food...We live in a highly civilized age, and if we fail to grasp its spirit we shall go to the wall before the oyster cultivators of

⁸³ Brooks, William K. 1891. *The oyster: A popular summary of a scientific study*. Baltimore: Johns Hopkins Press. p.164.

⁸⁴ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.3.

⁸⁵ Ibid. p.10-11.

⁸⁶ Ibid. p.11.

the Northern States, just as surely as the Indians have been exterminated by the whites.⁸⁷

Demand was bound to increase, and science had to come to the rescue, but scientific methods required private property. This was similar to, and based on, the basic Lockean notion of mixing labor with property found in all the high modernist historical narratives.

Marshall McDonald, Virginia's Fish Commissioner from 1878-1888, was a high modernist who saw things differently than Brooks. He felt the fisheries suffered from "wanton spoliation."⁸⁸ Shad were almost entirely gone from Virginia in 1878. McDonald blamed this on dams and improper catching techniques and technology. The solutions for him were fishways around dams, artificial propagation in hatcheries, and introduction of new species. At first he felt oysters needed similar remedies. McDonald quickly implemented most of his proposed solutions. He created the "McDonald fishway" in the late 1870s and it became a leading design. Shad numbers began to rebound due to hatchery operations and fishways. McDonald also experimented with the introduction of species such as carp. In 1888, he became head of the USFC and worked to expand their hatchery operations. These solutions proved harder to apply to oysters though, and he spent his first five years as Virginia commissioner studying them before outlining a plan. Despite his successful fish hatcheries, he came to feel artificial cultivation of oysters (i.e., growing spawn in hatcheries) would fail and so thought Virginia could only halt decline through "rational legislation."⁸⁹ He was "satisfied the starting point is in converting the

⁸⁷ Ibid. p.31.

⁸⁸ Virginia Fish Commission. 1879. *Annual Report of the Fish Commissioner of the State of Virginia for the Year 1878*. p.3.

⁸⁹ Virginia Fish Commission, 1884. *Annual Report of the Fish Commissioner of the State of Virginia for the Year 1883*. p.4.

oyster domain to private property.”⁹⁰ I could find no statements where he said all natural beds should be privatized, but several of his statements, including the one above, do imply this. He was thus high modernist in his approach to property, but not in his view of artificial cultivation science, although this was larger due to his view of its practicality. He was in favor of artificial cultivation if scientists found a way to make it possible.

The Connecticut and New York commissions posited a different role for science. They wanted planters to share best practices, in a fashion similar to farmers’ institutes. In their discussion of starfish they admitted that it was difficult to know what to do, even suggesting that not shooting coot (a bay duck) might help. One year they listed twenty different, sometimes conflicting, quotes they had heard on how best to combat starfish. They eventually recommend bounties. Tens of thousands of barrels of starfish were destroyed annually in the 1880s even without a bounty. Later, when Connecticut planters had overextended into areas where planting failed, the commission recommend extending a buy-out program to town-designated areas in state waters too. They were not sure why these areas failed. They said every oystermen had his theory, and these conflicted. What they felt was needed was a thorough comparison of the best areas with those that could not support oysters. This would take many years and vast amounts of time and money, but until then oystermen must continue to “grope in the dark” through “perplexing and costly experiments.”⁹¹

Blackford also repeatedly stressed that planters could profit by sharing information about advanced methods. In his first report he stated that:

⁹⁰ Ibid. p.5.

⁹¹ Connecticut Shellfish Commission. 1887. *Annual Report of the Shellfish Commissioners to the State of Connecticut*. p.16

unfortunately at present there are localities where the persons who are engaged in this kind of work have no conception that there are any methods which can advantageously take the place of those which have been established since the 'long, long ago' by old customs. Such ideas can only be rendered obsolete by showing these persons that there is something better.⁹²

In his next report, he blamed "the lack of scientific culture on the planted beds" as a cause of low harvests.⁹³

Commissions in New Jersey, Virginia, and Maryland all routinely reprinted scientific findings in their reports. They printed information from scientists such as Rutgers biologist Julius Nelson, George Brown Goode (head of the USFC), and Francis Wilson (an important USFC scientist). Maryland's 1880 Fish Commission report said artificial cultivation might work as a solution, but "it remains a matter of conjecture" and "it will require extended experiments before we can feel assured that the protection afforded in this manner will be sufficient."⁹⁴ In contrast, the first Virginia report, which describes a short fieldtrip with T. B. Ferguson, and George Brown Goode, James A. Miller (chief assistant to the USFC), and a Dr. Chapman of Baltimore (described as "an enthusiastic amateur") recommended opening a fish hatchery.⁹⁵ Baird offered personnel assistance and the commissioners decide to build four hatcheries. They were "perfectly satisfied...that enough is known about fish culture to ensure its success."⁹⁶ This report was also the first to feature a scientist: Professor J. R. Page of the University of Virginia. Page reprinted a long report by Jean Coste, Europe's leading aquaculturist and a specialist in oysters (see chapter five). Page believed the Chesapeake would soon become

⁹² Blackford, 1885. p.68.

⁹³ Blackford, 1886. p.5.

⁹⁴ Maryland Fish Commission. 1880. *Report of the Commissioner of Fisheries of Maryland*. p.160.

⁹⁵ Virginia Fish Commissioners. 1878. *Annual Reports of the Fish Commissioners of the State of Virginia for the Years 1875-6 and 1876-7*. p.3.

⁹⁶ Ibid. p.16.

depleted as England and France had, and thus it would have to adopt French planting methods. Page went on describe why these methods were the only realistic solution. He wrote that fishermen were too greedy and politicians simply pandered to what the fishermen wanted. What the Chesapeake needed were scientists who saw the laws of nature. Legislation should follow these natural laws.

Artificial cultivation fits the pattern of property where high modernist commissioners found a single solution to the oyster problem. As with property, it was based on revealing fundamental laws. It also contained an ethical narrowing to maximizing production. It shows why high modernist planning helped capitalists more. Like farm science, it was easier to explain how science would meet the needs of larger producers, as larger planters were the ones with the money, land, and technology to benefit from artificial cultivation. Like fish hatcheries, artificial cultivation of oysters fits neatly into Scott's model. The more populist commissioners often called for a more scientific approach, but this tended to mean they wanted planters to share information. Their advice was for something more like early farmers' institutes, which were started by experts but popular with small farmers.

4.3.7 Optimism

Scholars have remarked on the optimism of Progressive Era resource managers, and the literature paints this as overconfidence in the ability of science to control nature.⁹⁷ Among oyster commissioners, optimism was a feature of high modernist advice. It was more than a way to sell their idea or to gain leverage, they really believed their

⁹⁷ Langston, Nancy. 1995. *Forest dreams, forest nightmares: The paradox of old growth in the inland West*. Seattle: University of Washington Press.

knowledge production pictured the fishery and law of progress for the legislature for the first time, and they believed in the power inherent in mastering social and natural laws. Also, in the absence of refutation it was easier to be an optimist.

The Massachusetts reports exhibit a number of optimistic themes that reappeared in other states. The first theme was the “latent wealth” of the state’s bays. Belding believed planting could develop this “untold wealth” through the “reclamation of large portions of the waste shore areas.”⁹⁸ This optimistic theme was the same as that seen in the tax debate in the last chapter and was common in many legislative advisory reports. Belding’s biology background, and presumable familiarity with oyster population constraints, did not temper his enthusiasm.

Some of the high modernist commissioners were optimistic about artificial cultivation. Ferguson stated that it had “prospects so bright,” and lamented delays in experiments.⁹⁹ Brooks and Waddell were optimistic about science’s ability to improve productivity (Brooks would become less so later, see chapter five). They said the fishery would eventually be worth hundreds of millions annually at a time when it was earning around two million annually.¹⁰⁰ At the time, Maryland was the world’s most productive oyster region, yet they claimed a massive increase in productivity was possible.

Populist commissioners tended to be more cautious. Stevenson thought others were greatly exaggerating planting’s potential, and were doing harm to planters in the process. By exaggerating the potential wealth, it had made tongs desire to keep potential planting areas, thinking they could gather oysters there. He said Connecticut waters were highly productive, but he estimated deep water planters averaged twenty-five

⁹⁸ Belding, 1909. p.4.

⁹⁹ Ferguson, 1881. p.cv.

¹⁰⁰ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.8.

bushels an acre, not the four hundred some thought possible. He went on to say that no state had ever completely removed natural beds on purpose, and he saw these coexisting with planted beds. The latter could help the former by taking pressure off them and providing a market. Tongers could be the ones to start planting too. He said

The cultivating systems here outlined are by no means antagonistic to their interests; on the contrary, they more than any others are to reap the benefits. These men are familiar with the bay; they are familiar with the character of the grounds and with the methods of handling oysters; they are already fitted out with boats and implements for engaging in the business.¹⁰¹

This view that planting and tonging could be mutually beneficial, or at least interdependent, was an important element of populist advising, as was Stevenson's realism about planting yields.

4.3.8 Characterizing oystermen

One last difference was the way commissioners viewed oystermen. High modernist advisors tended to see tongers as backwards and planters as more progressive, which tied closely to the frontier analogy. It also showed an aesthetic, technological, and moral bias. Adas explains how Europeans often judged other cultures based on a technological hierarchy with Western industrial technology at the top, and that is the way these commissioners viewed the difference between planting and tonging.¹⁰² Although extreme at times, it is easy to understand the high modernist perception. Connecticut's planting fishery, with its steamships, packing houses, and millionaires, presented a striking contrast to a tonger with his rake-like tongs and small boat.

Knowles in Connecticut tied this view to tongers' property traditions, saying:

¹⁰¹ Stevenson, 1894. p.292.

¹⁰² Adas, 1989.

that pestiferous notion that oysters, in their native element, cannot become individual property, and that therefore, to take them wherever found is not *stealing* in morals, though it be in law, would find propagandists and advocates no where but among 'long-shore-men of bad reputation for honesty, and landsmen of no reputation worth having. (*Italics in original*)¹⁰³

Belding in Massachusetts described tongers as “incapable of working together for the best interests of the towns or of the public.” Belding also discussed ethnic and class issues. He said the shore was “combed by...irresponsible aliens” and by “exemplars of the ‘submerged tenth.’”¹⁰⁴ He identified two classes of fishermen. The first was a “permanent resident, usually native born, bound to a definite locality by ties of home and kin and long association, – a most useful type of citizen.” Whereas the second was:

a more rapidly increasing class, – foreign born, unnaturalized, nomadic, a humble soldier of fortune, a hanger-on in the outskirts of urban civilization, eking out an existence by selling or eating the shellfish from the public grounds. Too ignorant to appreciate the importance of sanitary precaution, the alien clammer haunts the proscribed territory polluted by sewage, and does much to keep the dangerous typhoid germ in active circulation in the community.¹⁰⁵

This class typically engaged in “petty buccaneering.” Private property would force “these irresponsible wandering aliens to acquire definite locations,” thereby improving them. Belding also discussed “an unprogressive element...who prefer to reap where they have not sown; who rely upon what they term their ‘public right.’”¹⁰⁶ It is not clear if this last comment referred to immigrants or merely tongers in general.

New Jersey commissioners expressed similar, although less extreme, views. According to the commissioners, current practices on the natural beds “entail poverty, ignorance and their attendant train of evils upon those who are content to eke out a scanty

¹⁰³ Knowles, 1864. p.7.

¹⁰⁴ Belding, 1909. p.6.

¹⁰⁵ Ibid. p.12.

¹⁰⁶ Ibid. p.12.

subsistence in working them.”¹⁰⁷ On the other hand, “In those sections of the State visited by the Commission, where oyster planting is most extensively engaged in, the people, as a rule, were found to be in a busy and prosperous condition; and on every hand evidence of enterprise, thrift and good citizenship were to be observed.”¹⁰⁸ These quotes show the commission’s bias toward planting and how this tied into the way they characterized oystermen.

McDonald Lee, Virginia’s Commissioner from 1906-1912, submitted his views on oystermen in his reports, and based recommendations on these. He claimed that “[m]any parts of the oyster country are afflicted with a worthless class, who go north as waiters or hostlers in summer,” and recommended a permanent residency requirement to keep “this vagrant class” out.¹⁰⁹ The other benefit of this proposal was “it means the farmer can find more ‘help’,” as it would keep oystermen in Virginia in the summer.¹¹⁰ This “class” felt, according to Lee, that everyone had rights to oysters and “they glory in their smartness if they can take them without being apprehended.”¹¹¹ Where tonging decreased, this “weeded out” some of the law breakers, leaving “a better class” behind to continue tonging.¹¹²

Lee discussed the racial aspect of the industry too. He said that “some of the colored and a large majority of the whites” were good citizens.¹¹³ Whites comprised about half the Virginia tongers according to Lee, so the implication is that most of the African Americans were part of the “lawless class,” and this class was mostly African

¹⁰⁷ New Jersey Oyster Commission. 1884. *Report of the Oyster Commission*. p.17.

¹⁰⁸ Ibid. p.17.

¹⁰⁹ Virginia Board of Fisheries. 1907. *Report of the Board of Fisheries*. p.9.

¹¹⁰ Ibid. p.10.

¹¹¹ Ibid. p.10.

¹¹² Ibid. p.15. Virginia Board of Fisheries. 1908. *Report of the Board of Fisheries*. p.xx.

¹¹³ Virginia Board of Fisheries. 1907. *Report of the Board of Fisheries*. p.10.

American. Lee said whites complained that blacks were hard to find as cull-boys (a helper who culls oysters while the other person tongs), as they started tonging so young, and white oystermen were often having to take their children out of school to do this. Lee advised raising license fees as a way to keep blacks out, but he recognized not all whites would agree to this. He felt it would not only benefit whites looking for cheap labor, but might be black oystermen's "salvation," since "the improvident negro" spent what he made as fast as he could, and this proposal would force them to work more hours and make more money as employees.¹¹⁴ Instead, "[t]he average negro tonger...is the personification of independence."¹¹⁵ Curtailing public property would also help undermine these men's livelihood. Lee's statements fit race into the larger theme of forcing tongers to become efficient wage laborers for their own good.

Stevenson again presented the most articulate populist alternative. He defended Maryland tongers' morals, saying:

There are few workmen in America more independent than these. At almost anytime during the season a tongmen can in a good working day catch from four to twelve bushels of oysters, for which there is always a demand almost at his door. Then having sufficient to supply his temporary needs he usually takes things easy. While some are indolent and work only when compelled by necessity, yet as a class they compare favorably in industry and morals with any other body of men similarly situated.¹¹⁶

Here he challenged the common stereotype that tongers were lazy and complimented their independence. When discussing current laws, he wedded tongers' conduct to the reasonableness of traditional management practices:

The fishery in Maryland is not, as frequently supposed, a haphazard undertaking conducted by a class of men depending for success on violations of the State laws, but is on a firm, orderly basis, any sudden, revolutionary change in which would

¹¹⁴ Ibid. p.17.

¹¹⁵ Ibid. p.17.

¹¹⁶ Stevenson, 1894. p.234.

work great hardship and distress to the thousands of citizens depending on it for a livelihood.¹¹⁷

The difference between these views and Lee's can be seen as exemplifying the split between American perceptions of farmers as Jeffersonian bastions of democracy on the one hand and backward rubes on the other.¹¹⁸

4.4 Institutional context

To understand the process and content of knowledge production, it is important to consider the institutional context of the various organizations producing knowledge. The USFC, some of the state commissions, and the two universities (Johns Hopkins and Rutgers) discussed later all were institutions with pressure or desire to apply science and knowledge production for high modernist ends. There were several reasons for this. Johns Hopkins University, whose chief morphologist, William Brooks, was the U.S.'s the leading oyster scientists, was devoted to showing the efficacy of applied research.¹¹⁹ Oysters were a good place to do this because Brooks was the country's foremost morphologist, and his optimism about oyster science and cultivation rested on his discoveries concerning oyster development and his faith that laboratory science could reveal the keys to this. He thought his oyster solution proved the usefulness of the Johns Hopkins approach. Laboratory science did not have a way to solve political problems that beset the fishery, but it could, Brooks believed, be used to increase production. Isaiah Bowman, Johns Hopkins' first president, also weighed in on the oyster problem, calling it

¹¹⁷ Ibid. p.290.

¹¹⁸ Kirkendall, Richards S. 1986. The agricultural colleges: Between tradition and modernization. *Agricultural History* 60 (2): 3-19.

¹¹⁹ Maienschein, Jane. 1991. *Transforming traditions in American biology, 1880-1915*. Baltimore: Johns Hopkins Press.

one of the world's four worst examples of resource misuse and agreeing with Brooks' prescriptions.¹²⁰

The USFC followed a different path to similar ends. Spencer Baird was able to get funding for the USFC from Congress by arguing that disputes between fishermen and government commissioners in Rhode Island and Massachusetts needed federal intervention.¹²¹ In its early years however, Baird used the USFC partly as an adjunct to the Smithsonian Institution sending federal boats on collecting expeditions for the National Museum.¹²² During Baird's tenure, the USFC was open to a wide range of non-applied scientific inquiry. However there was always pressure to make it more applied. External pressure came from the American Fish Culturists Association (AFCA), which helped persuade Congress to create the USFC. Internally, many scientists saw the mission of the USFC and other federal agencies as educating the public about rational methods of resource use. After Baird's death, the Cleveland administration cut budgets and forced a more applied focus, and his appointment of Marshall McDonald, an engineer and avid culturist, in 1888, reflected the narrower mandate of the post-Baird commission.¹²³ By focusing predominately on fish culture, and public education to adopt new culture methods, the USFC supported the high modernist side of Progressive Era management more so than alternatives. Baird was trying to create a professional definition for fisheries biology that was more expansive than a mere aid to fish culture, but his view of science contained an evolutionism that saw fishermen progressing toward more rational resource

¹²⁰ Keiner, 2001.

¹²¹ Smith, Tim. 1994. *Scaling fisheries: The science of measuring the effects of fishing, 1855-1955*. Cambridge: Cambridge University Press. Weber, Michael. 2002. *From abundance to scarcity: The history of the National Marine Fisheries Service*. Washington, DC: Island Press.

¹²² Allard Jr., Dean. 1978. *Spencer Baird and the U.S. Fish Commission*. New York: Arno Press.

¹²³ Pauly, Philip. 2000. *Biologists and the promise of American life: From Meriwether Lewis to Alfred Kinsey*. Princeton: Princeton University Press.

use under scientific tutelage, and this remained and accommodated the more narrow-focused science that followed.

State oyster commissioners eventually founded a national association and combined forces with the national association of leading planters and packers. This combination resembled the USFC's tie to the AFCA, and both combined to lobby government funders. It also resembled the ties between the agricultural extension agencies and the large farmers who could benefit from a focus on increasing production.¹²⁴ The reason for a production-maximizing focus in the agricultural extension service was the same as in the USFC: applied science seemed to offer the most obvious results when applied in this way, and such applications led to alliances that could bring in political support.¹²⁵

However, not all state commissions sought out these partnerships. One reason was that state commissions were not as involved in science. The types of knowledge they produced, mainly surveillance knowledge, fishery statistics, and maps, lent themselves just as readily to helping small tongers and the wild fishery as large planter/packers and oyster cultivation. The oyster navies were similar. The navies professional definition did not require a rationale that favored wealthier segments, indeed the opposite was more true, and their political base was broad as well. Sanitation commissions were also producing knowledge with broad utility. Collection of industry statistics or registering vessels did not increase production, and these types of knowledge production proved

¹²⁴ Marcus, Alan. 1985. *Agricultural sciences and the quest for legitimacy: Farmers, agricultural colleges, and experiment stations, 1879-1890*. Ames: Iowa State University Press. Busch, Lawrence, and William Lacy. 1983. *Science, agriculture, and the politics of research*. Boulder, Westview Press. Danbom, 1986. Rosenberg, Charles. 1977. Rationalization and reality in the shaping of American agricultural research, 1875-1914. *Social Studies of Science* 7: 401-422.

¹²⁵ Hamilton, 1990.

their utility by presenting comprehensive pictures to legislatures or by lessening conflict. These differences in professional definition, application of knowledge, and political support are institutional factors (i.e., Hull's "enabling conditions") that help explain the pull toward high modernist, pro-planter knowledge production in some instance and not others. All of these institutions, except for the sanitation commissions, were created due to conflict over or perceived decline in oysters, but the different types of knowledge they produced meant they legitimized themselves in different ways, some more high modernist than others.

Literature on the "organizational synthesis" is also important for understanding this pattern. This literature looks at how government agencies and professional groups formed alliances for mutual gain.¹²⁶ In the explaining this process in agricultural history, Rosenberg describes these public-private partnerships as "entrepreneurial," and says not all agricultural scientists were able to successfully form these, which meant the more entrepreneurial scientists were able to position themselves better by gaining more support.¹²⁷ Oyster commissioners often lacked the power to make legislatures heed their advice, and so they needed and sought out political allies in the private sector. Hamilton calls these partnerships "associative state-building," which denotes the way government officials tried to expand their authority and influence through these linkages.¹²⁸ Officials needed to show how their agencies could benefit private sector partners, and was one reason agricultural and fisheries science tended to benefit larger producers.

In oysters, this pattern is best seen in the strong link that developed between the main public and private professional organizations: the National Association of Shellfish

¹²⁶ Balogh, 1991.

¹²⁷ Rosenberg, 1971.

¹²⁸ Hamilton, 1990.

Commissioners (NASC) and the Oyster Growers and Dealers Association (OGDA).

Charles Bacon, head of the New Jersey Bureau of Shellfisheries, founded the NASC in 1909 to “exchange griefs and lay plans to win success.”¹²⁹ Bacon had been in his state’s commission, and its special advisory commission for seven years, but felt he had not yet convinced the legislature “that the oyster is not a joke.” He said “I have been, with the other Commissioners of my own state, so cast down by the failure of our Legislature to legislate for its general good, that I have felt totally discouraged and ready to quit the service.”¹³⁰ Bacon founded the Association to try to remedy this problem. The Association was a venue where commissioners debated and defined the oyster fishery’s problem and its solutions, with the chief aim to plan strategies for improving legislation. At the first meeting, which drew sixty-four commission members, Frank Wood, New York’s Superintendent of Marine Fisheries, expressed the purpose of the new organization in the opening speech, saying “we hope by our Association here, by mingling with each other, exchanging views, to get at better methods, to get at unified laws.”¹³¹

At the second convention in Mobile in 1910, Bacon outlined the setbacks the new Association was facing in its legislative advising. He said

In several of our states there have been seeming setbacks in the efforts of some of our Commissioners to push forward with legislation that was meant for the betterment and advancement of the Industry...The point of strongest resistance to these efforts has been the influence which ought to be most strongly arrayed for the movements, the men engaged in the industry themselves. But it is so difficult to convince some of these hard-headed and honest sons of the deep that we are striving with all sincerity for their good.¹³²

¹²⁹ Carriker, Melbourne Romaine. 2004. *Taming of the oyster: A history of evolving shellfisheries and the National Shellfish Association*. Hanover: Sheridan Press. p.9.

¹³⁰ Ibid. p.11.

¹³¹ Ibid. p.19.

¹³² Ibid. p.24.

The conference papers covered three topics: science, sanitation, and planting. Often these overlapped. Numerous scientists presented at NASC meetings, and most of their talks related to planting. The Association's mission statement stressed the science-planting link too, stating that the purpose of the Association was "to promote the cultivation of edible and bait mollusks; to gather and disseminate information on the methods adopted in various places."¹³³

Henry Rowe founded the Oyster Growers and Dealers Association in 1908 to address the decline of sales following typhoid scares (see chapter eight). It was an association of the largest planters and packers. Its president and select members gave speeches at NASC meetings, which numerous planters attended each year, demonstrating the close tie between the two professional groups. Both initially had New York headquarters.

As the founder and first President of the NASC, Bacon's views represent the type of legislative advising he and the NASC promoted. Bacon headed New Jersey's special temporary advisory commission in 1902. The New Jersey Commission for the Investigation of the Oyster Conditions toured the state and made recommendations to the legislature. Its report no longer exists, but the *New Jersey Courier* had a series of articles that provided details on the commission's recommendations.¹³⁴ The commission's main recommendation was to eliminate the state's shell commissions, which collected shells from packing houses and placed them on or around oyster beds to provide attachment sites for larval oysters and encourage the growth of oyster beds. The shell commissions were based on "[a] crude conception of the state's duty in such matters and a still cruder

¹³³ Ibid. p.29.

¹³⁴ *New Jersey Courier*, May 22, 1902.

knowledge of the law governing the propagation of oysters.”¹³⁵ Furthermore the commission stated, shelling offered no real benefits to the state. The commissioners offered other unpopular prescriptions, saying that all bottoms, including natural beds, should be sold or leased. Although they recognized that such a proposal would arouse violent opposition, they went on to characterize their opponents as “unqualified and ignorant.”¹³⁶

The New Jersey Shell Commission responded by justifying its existence. Its commissioners claimed the majority of planters were “greedy and covetous...grabbing up everything in sight” and having “an antipathy to anything in legislation that will restrict their greed.”¹³⁷ They claimed that prior to the Shell Commission, it was common for planters to induce tongers to catch and sell seed out of season, giving them a lower price for this. Planters did not like them because of this and because they enforced public bed lines.

Bacon’s commission went on to recommend consolidating all New Jersey commissions into one administrative unit. However, to mollify their enemies, they made it include all existing commissions (New Jersey had four types of commissions at this point) and added more members to the state commission, bloating oyster administration and making it an easy target for critics. Their bill failed to pass.¹³⁸ Bacon’s views were heavily pro-planting and he wanted radical change in the fishery. His best chance for influential political alliances was with large planters, but he failed to gain the political

¹³⁵ *New Jersey Courier*, January 29, 1903.

¹³⁶ *New Jersey Courier*, February 12, 1903.

¹³⁷ *Ibid.*

¹³⁸ *Ibid.*

support he needed. This failure was part of why Bacon formed the NASC and partnerships with wealthy planters and packers.

4.5 Federal data gathering

Ingersoll: North American oysters

The USFC made its first effort to create an overall picture of U.S. fisheries in conjunction with the 1880 census. They hired five field assistants to carry out extensive surveys, assigning them to the following fisheries: Atlantic, Pacific, Gulf of Mexico, Great Lakes, and Oysters. Spencer Baird, head of the USFC, justified giving oysters their own report, saying:

Certain branches of trade which are in the hands of a distinct class of men are well worthy of special investigation. Chief among these is the oyster trade, which absorbs more capital than all other branches of fisheries, and which has never been thoroughly studied.¹³⁹

The surveyor he hired for this task was Ernst Ingersoll. His study is still regarded as a benchmark by shellfish scientists and is the principal historical source on shellfisheries of the 1700s and 1800s.¹⁴⁰

Baird's instructions to Ingersoll survive, and they show the importance of local knowledge in his survey.¹⁴¹ Baird instructed the five field assistants to visit every settlement and write the fullest possible findings in the field. Prior to the survey, Baird sent out circulars to all fishing towns. Baird used these to compile a directory of all post offices within three miles of the coast and hundreds of names of persons ("fishery-capitalists, manufacturers, skippers, fishermen, collectors of customs, post-masters, and

¹³⁹ Spencer F. Baird papers, National Archives, USFC collection, record group 22.

¹⁴⁰ MacKenzie, Clyde L. 1991. Bibliographic memoir of Ernst Ingersoll: Naturalist, shellfish scientist, and author. *Marine Fisheries Review* 53 (5): 23-29.

¹⁴¹ Spencer F. Baird papers, National Archives, USFC collection, record group 22.

light-house keepers”) willing to talk to the surveyors. Baird’s directions included a long, detailed list of approximately sixty items surveyors should ask about. Baird wrote that old newspapers “cannot be too strongly recommended” and the value of oldest inhabitants’ information “cannot be overestimated.”¹⁴²

Ingersoll’s report followed Baird’s instructions for the most part. He spent twenty-two months gathering information from knowledgeable oystermen, and also packers and merchants. In smaller towns he relied more on small planters and tongers, whereas in the areas with extensive planting, he relied more on the larger planters. He always went to the towns and clearly talked to many people, until he came to Maryland. Perhaps the state simply had too many oyster towns, because he switched to reprinting information verbatim from one informant, a pro-planting oystermen, and did not report on every town. Ingersoll’s statistics were based on what oystermen told him, so their accuracy is only approximate. Despite these limitations, his report provided the first comprehensive picture of the fishery.

In his papers, Baird described the current state of the USFC’s knowledge of the fishing industries. Following the 1880 reports Baird said the USFC had 20-30,000 pages of manuscripts, and much had already been done to give an accurate statistical picture of the nation’s fisheries. The first comprehensive picture of the U.S. fishing industry had emerged in the 1880s, and it relied heavily on local knowledge.¹⁴³

This was common for early reports that sought to picture the fisheries, and scholars have begun to look more closely at early scientists’ utilization of local

¹⁴² Ibid.

¹⁴³ Goode, George Brown. 1884-1887. *The fisheries and fishery industries of the United States*. Washington, D.C.: Government Printing Office.

knowledge.¹⁴⁴ Bigelow's landmark *Fishes of the Gulf of Maine* would have been impossible without his extensive relationships and conversations with fishermen.¹⁴⁵ Charles Townsend's whale biogeography studies were based entirely on whaler's knowledge and log books.¹⁴⁶ Bigelow is still in print and scientists use the "Townsend charts" today to determine baseline whale populations.¹⁴⁷ This is an under-explored topic; most historiography of conservation assumes federal scientists created knowledge entirely unaided by resource users. This pattern fits some resources, such as the National Forests, better than others.

Dean: European and Japanese oysters

A few scientists made overseas trips to study other countries' oyster industries. Their goal was to look for practices that could improve their own country's production. The first of these was of Victor Coste, a French scientist who went to the Mediterranean and brought cultural methods from Italy to France. His colleague de Broca came to the U.S. in 1863 and published a report on American methods. Bashford Dean was the American scientist who went abroad, going to Europe in 1890 and Japan in 1901. The trans-Atlantic exchanges resulted in few changes, partly due to differences in prices; U.S. oyster prices were too low to support labor-intensive French and Japanese practices. Dean's reports are interesting though as examples of valuing local knowledge and

¹⁴⁴ Schneider, Daniel W. 2000. Local knowledge, environmental politics, and the founding of ecology in the United States: Stephen Forbes and 'The Lake as a Microcosm' (1887) *Isis* 91 (4): 681-705.

¹⁴⁵ Bigelow, Erastus B. and William W. Welsh. 1925. *Fishes of the Gulf of Maine*. Washington: Government Printing Office.

¹⁴⁶ Townsend, Charles H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. *Zoologica* 19 (1): 1-50.

¹⁴⁷ Reeves, R., Smith, T. D., Josephson, E., Claphan P., Woolmer, G. 2004. Historical observations of humpback and blue whales in the North Atlantic Ocean: Clues to migratory routes and possibly additional feeding grounds. *Marine Mammal Science* 20 (4): 774-786.

practice. Dean felt U.S. fishermen had much to learn from other countries. He was a scientist and published on other fishery topics, so it is clear he thought science could aid the fishery, but he also thought practices developed by fishermen elsewhere could help too.¹⁴⁸

Dean work fits into a large effort to bring back agricultural knowledge from around the world to metropolitan centers in industrialized countries. An example similar to Dean's is F. H. King's *Farmers of Forty Centuries*.¹⁴⁹ King was the Chief of the Division of Soil Management of the U.S. Department of Agriculture, and he went to Japan, Korea and China trying to understand the practices of peasants, not scientists, who practiced "permanent agriculture" in these countries. It was an admission of their superiority, and Dean's work was written in the same spirit. Both are remarkable for their humility towards foreign cultures at the high point of U.S. imperial expansion and manifest destiny. Dean and King's studies were like much colonial collecting, but they were based on a different attitude toward foreign peoples, and they were the reverse of high modernist commission reports that denigrated average oystermen's skills. Dean did go to France, which was supposedly the paragon of oyster culture, but he reported on natural bed tonging there too, and he rejected the French cultivation methods as too labor-intensive for the U.S., even while he recognized their value for French economic and ecological conditions.

¹⁴⁸ Dean, Bashford. 1891. Report on the European Methods of Oyster Culture. In *Bulletin of the United States Fish Commission*. Washington, D.C.: Government Printing Office. Dean, Bashford. 1902. Japanese Oyster Culture. In *Bulletin of the United States Fish Commission*. Washington, D.C.: Government Printing Office.

¹⁴⁹ King, F. H. 1911. *Farmers of forty centuries, or permanent agriculture in China, Korea and Japan*. Emmaus: Rodale Press.

4.6 Discussion: two pictures, two orders

Ingersoll and Dean relied on and compiled local knowledge, and Stevenson and Blackford offered recommendations that sought to preserve local practices. Stevenson wanted to show the reasonableness of oystermen's actions. He thought they were practical adaptations and any future improvement had to have its basis in these traditions. Blackford gave the same advice in a fishery with greater planting. He did not cite social laws as justification for his advice, but rather relied on observations. Both he and Stevenson valued science and thought it could spread new and useful ideas for all oystermen, but they did not state that social or natural science determined a law of progress. They fit the model discussed in the last chapter, where commissioners sought to make oystermen's management more rational and bureaucratic without losing its traditions. Interestingly, commissioners like Blackford and Stevenson seem to have spent more time holding meetings and talking with oystermen than many of their more radical reformist counterparts. It is unclear if this was because they felt comfortable around oystermen to begin with, or if their contact led them to greater respect for oystermen.

At the other extreme were commissioners like Belding, Knowles, and Brooks who were much more like the high modernist planners Scott describes.¹⁵⁰ They were all optimists who saw great potential wealth in the oyster beds. They saw older traditions as wasteful and backwards. For them, the future lay in planting, and they used social laws of historical progress to explain why this had to be so. In short, they wanted to radically restructure the industry, from conservation laws to harvesting technology and property rights.

¹⁵⁰ Scott, 1998.

This high modernist narrative has its roots in colonialism and enclosure. Drayton identifies a narrative common in colonial thinking that thought progress required enclosure of common property.¹⁵¹ He shows how this began in England and continental Europe, with the slow spread of the enclosure movement. Other scholars, such as E. P. Thompson and Raymond Williams, document this within England,¹⁵² whereas Drayton shows how it spread from there with colonialism. Adas documents how Europeans saw technological superiority as a mark of their own civilization, dividing people on a ladder of progress based on their tools.¹⁵³ The more radical planners' dismissal of tonging as anachronistic, especially as compared to the large-scale, steamship-employing Connecticut planters, contains the same technological ranking and evaluation.

These narrative themes form the cultural background for oyster commissioners' advice, but there was also a professional imperative. Abbott describes how professional groups define problems and solutions to legislative and popular audiences.¹⁵⁴ Commissioners were charged with performing this task too. As McEvoy notes, privatization was an attractive solution because it seemed to offer a flexible way to solve multiple problems at once.¹⁵⁵ In the oyster case, a property solution also fit commissioners' ideas about progress. In addition, because of the different technologies employed, the property solution fit their ideas about technological progress too. Property solutions were also compelling because the state had limited reach, so it needed an

¹⁵¹ Drayton, 2000.

¹⁵² Williams, Raymond. 1973. *The country and the city*. New York City: Oxford University Press.
Thompson, E. P. 1963. *The making of the English working class*. London: V. Gollancz.

¹⁵³ Adas, 1989.

¹⁵⁴ Abbott, 1988.

¹⁵⁵ McEvoy, 1986.

intervention that would produce results beyond the initial act, and property seemed to be the lone candidate for this type of intervention.

High modernist advising also fits the pattern described in the governmentality literature. This literature adds to the co-production concept by including the important idea that the state was trying to govern through the use of social laws that would make society more self-regulating. High modernist commissioners identified laws of economic development involving property and technology. In their view, the problems of the fishery (conflicts, over-harvesting) occurred precisely where the fishery departed from these laws. The legislatures could govern less in the long run by making targeted changes that put the fishery in accordance with these laws. Once this was done, the problems would go away. But the commissioners realized that not all legislators, and even fewer among their constituency, agreed with their advice, so the advisory reports had to make the fishery's problems and the social laws explaining them visible. They wanted this new picture of the fishery to convince legislators and oystermen to produce the commissioners' ideal order, which would allow the state to govern by efficiently following social laws. However, this is a case of failed governmentality, as the commissioners' picture and advice were rejected.

This promulgation of efficient principles for ordering society was central to the Taylorist side of Progressivism. Several factors led to this in the oyster case. One was governmentality's appeal for weak commissions facing large problems and much uncertainty. Commissioners' social laws claimed to explain all the fisheries problems and they promised a certain solution. This solution focused on a single variable (property), and although it would be difficult to implement in the short run, they thought this would

make the fishery almost self-governing. Seeing social laws gave commissioners hope they could do more with less. This is a common reason for narrow ideologies' appeal.

The other reason efficiency principles were appealing to oyster commissioners, and Progressives in general, was because of the effect of the shift in scale on knowledge production. Producing the first comprehensive knowledge of large, complex systems invited simplification. Oyster commissioners had to produce the first knowledge about a complex and diverse fishery. They had little time for this; they had to explain a great deal and they felt pressure to produce useful results. Simple, abstract depictions of problems facilitated narrow ideological solutions. These solutions had simple, single-variable goals, such as oyster commissioners' increasing privatization or the larger Progressive maxim of maximizing productivity. But not all commissioners responded this way; there were two gospels of efficiency. The populist commissioners used knowledge production to try to preserve traditions. These traditions grew out of conflict, were not always equitable or sustainable, and oystermen were often ambivalent about them. The point here is that populist commissioners needed more nuanced description of the fishery and its problems if they wanted to maintain some of the older management practices.

Chapter five: natural science

5.1 Introduction: oyster science's high modernist moment

Between 1878 and 1885, U.S. oyster scientists developed a research program designed to solve the oyster fishery's problems through artificial cultivation, or growing oysters in hatcheries. This program followed the larger trend in applied fishery science toward hatcheries at this time. As such, it provides an opportunity to explore high modernism in U.S. fisheries science.

In studying the history of science, Hull advises looking at “intellectual lineages,” and he advises looking at concepts at the centers of these lineages.¹ Hull uses this method to explain why scientists chose between rival concepts, and this makes his work especially appropriate for oyster science. U.S. oyster scientists' intellectual lineage stretched back to Europe in the 1850s and the work of Victor Coste, Europe's aquaculture science pioneer. The Americans used Coste's ideas to advance a solution to the oyster fishery's problem that focused on using science to maximize production. Like Scott's cases, they focused on a single narrow aspect of oyster biology to achieve this. To understand why scientists chose this path it is necessary to know that there was an alternative view, associated with the more ecological work of Karl Mobius that said artificial cultivation would never succeed. U.S. scientists ignored this advice. The question is why they chose the high modernist lineage over its more cautious alternative.

One reason was the pressure early agencies faced to justify their funding by producing tangible results. The science studies and sociology of professions literature looks at how science functions as a source of legitimacy.² There was a debate within the

¹ Hull, 1988.

² Arnold, 2000. Abbott, 1988.

USFC over pure versus applied science, and there was much outside political pressure for the latter. Patronage from wealthy planters affected science too. Both promoted oyster science's production-maximizing focus, which favored the Coste lineage. The science studies literature that stresses the "co-production" of science and the social order also helps interpret why scientists chose to follow Coste.³ The literature on co-production looks at the way science and people's perception of themselves and the world co-evolve or shape one another. This is an important issue in the oyster case because scientists' choice to pursue artificial cultivation was shaped by their ideals and their cultural context, and their science sought to reproduce those same ideals in others. In other words, they hoped the results of their science would demonstrate the efficacy of artificial cultivation.

To recapture the high modernist choice to follow Coste, one has to understand the appeal of artificially cultivating oysters. For one, it offered a way to de-politicize the highly contentious oyster question. Boosting productivity would do this by lessening the thorny distribution and access conflicts. Science would also de-politicize the oyster problem by serving as a guide to policy. Scientists expected that artificial cultivation would be so successful that it would convince oystermen, tongers in particular, to reform the industry to take advantage of this new process. This would help expand planting. The link between productivist science and the oyster fishery followed a pattern similar to that in agricultural science at this time where scientists tended to have an easier time helping the larger producers.

Science studies literature also sees nature as an "actant."⁴ In the oyster case, nature "resisted" artificial cultivation and caused experiments to fail. Laboratories and

³ Jasanoff, 2004.

⁴ Latour, 1999.

test ponds were controlled environments designed so scientists could limit and manipulate variables. But scientists never had full control over their own labs; nature kept intruding and ruining their experiments. Ultimately, high modernist artificial cultivation science failed in the period.

The chapter begins by describing European oyster science in the middle and late nineteenth century, and moves on to discuss how U.S. scientists adopted and modified these ideas and practices. The U.S. discussion first provides an overview of scientists' activities relating to natural science and artificial cultivation, and it then looks at scientists' ideas about the oyster fishery and the way they argued for support.

5.2 European origins

To understand U.S. scientists' activities and ideas, it is necessary to understand mid-nineteenth century European oyster science, as U.S. scientists cited French scientific findings continuously as a rationale for action. In France, oystermen had long fattened oysters in methods similar to that practiced in the U.S., but in the 1850's there was an impetus to move beyond this. Partly this was driven by declines in natural oyster beds. The other factor was the growth of fish culture in general at this time.⁵ France was the western world's leader in fish culture. The leader in this field was Jean Victor Coste, who, in the early 1850's, turned his attention to oysters.⁶

The French government sent Coste on an expedition to study the potential for fish culture in the Mediterranean in 1853. On this trip he stopped at Lake Fusaro in Italy and

⁵ Coste, Jean Victor. 1851. *Voyage d'exploration sur le littoral de la France et de l'Italie*. Translated in USFC. 1883. *Report of the Commissioner*. Washington D.C.: Government Printing Office.

⁶ Kinsey, Darin. 2006. Seeding the water as the earth: The epicenter of and peripheries of a western aquaculture revolution. *Environmental History* 11 (3):527-566.

saw people collecting oyster spat for planting. Lake Fusaro was a freshwater lake, but a man-made canal allowed in salt water. Although there are old Roman records of oyster farming, Lake Fusaro was probably the only place still practicing this in Europe. Coste's trip convinced him that similar collection methods would work for oysters on the French coasts. He and others would often refer to Lake Fusaro as the cradle of oyster culture, investing it with almost mythic proportions. Coste included pictures of the lake that showed it from the perspective of an explorer crossing a ridge seeing a revelation below, which contrasted with the technical pictures he usually used (see figure 5.1). The latter are designed as informative diagrams. Coste wrote that the small lake preserved an uninterrupted tradition of oyster culture founded by Roman cultivators two millennium past, furthering the lake's image as a cultural refuge.⁷

Around the same time (1853) de Bon was asked to restock oysters in Rance and Saint Malo by means of oysters gathered at Cancale. This experiment was successful and proved to de Bon that transplanted oysters would still spawn. His success allowed him to establish an experimental park at Saint Servan in 1854. In 1855 "he announced to the minister that the question of artificial reproduction was for him definitely settled in the affirmative."⁸

Coste visited de Bon at Saint Servan in 1857 and this confirmed his earlier theories about the possibility of using spat collectors. He convinced de Bon to experiment in this direction too, and in 1858 de Bon asked the Ministry of the Marine for permission to begin spat collecting experiments at Cancale, which they granted. The next year his

⁷ Coste, 1851.

⁸ De Bon. 1875. Report to rear-admiral the Marquis of Montaignac, Minister of Marine and the Colonies. Translated in USFC. 1883. *Report of the Commissioner for 1880*. Washington D.C.: Government Printing Office. p. 890.

experiments there were copied on a much larger scale by private culturists, and de Bon reported that “[t]he experiment was crowned a complete success.”⁹ Coste also began studying oyster culture. He published a report in February 1858 that attracted much attention. In it he predicted that the whole French coast could be made to produce abundant oysters, and he asked the government to finance experiments demonstrating his dream’s feasibility.¹⁰

The Minister of the Marine provided generous support. Coste took three million oysters from Cancale and Treguier and deposited these in April 1858, using two small government steamers to tow a flotilla carrying the oysters. He used shells as collectors in the same places, and anchored and suspended long bundles of sticks to act as spat collectors. He posted watch boats permanently on these spots. At the end of the spawning season the collectors were covered in spat. Following this success, Coste published another report in December 1858 showing his results and asking for support to duplicate these efforts across the entire French coast. This report again received much attention and publicity. In July 1859 Coste was given a steamer to direct his experiments and coordinate with oyster culturists working under the government. He took half a million oysters from Cancale and distributed these at Saint-Brieuc to enrich its bottom. He purchased two million more from England and took these to Bordeaux where they were shipped by rail to the Mediterranean and distributed at Thau and Toulon. He restocked Brest, and used English oysters to stock an oyster reservation at l’Anse de la Forest near Concarneau that was meant to supply nearby beds. The following year, 1860, he

⁹ Ibid. p.890.

¹⁰ Ibid.

established two model “parks,” or oyster farms, at Arcachon to serve as breeding beds for the basin (and also to serve as source for trials of different collectors).

Coste’s initial success led interested parties to solicit numerous concessions from the Ministry of the Marine, especially along the Brittany and Normandy coasts, the coast from Loire to Gironde, and also at Arcachon. Oyster farms were rapidly established on these and numerous oyster farmers began experimenting with artificial cultivation via spat collecting. Many capitalists invested large sums of money in these enterprises. In the early 1860’s, many of these places experienced great success. The most successful were at Saint-Brieuc, Re, and Arcachon; they also had decent success at Brest, Toulon, La Rochelle, and Marennes.

French oyster farms at this time were very different than anything in the U.S. They made extensive use of spat collectors. After some experimentation, the most popular collectors were ceramic tiles coated with a weak mortar. The mortar flaked off easily, making it easier to detach young oysters. The tiles were suspended in the water on an oyster farmer’s plot, and they intercepted oyster larvae, giving the larvae a clean surface for attachment. Larval oysters drifted in from nearby beds, some of which were natural beds and some of which were the ones restocked by Coste. After the spawning season, the spat were removed from the tiles and placed in ponds or “claires” dug into the shallow bays or coastal marshes. These ponds were often submerged at high tide, and when the tide receded, the level of the ponds’ banks kept water in. The oysters would mature in these ponds. There were numerous local variations on this basic method. Although oysters had been moved for fattening and flavoring in France for many years, this system of “parks” did not begin until the late 1850s and it started in conjunction with

de Bon and Coste's experiments. It was more labor intensive than the U.S. system, and thus depended on the higher prices for oysters in Europe.¹¹

After a few years of success, most of these experiments failed. Storms scattered the oysters and collectors at Saint Brieuc. Fishermen took many of the oysters planted at Brest and their natural beds declined at the same time. All of the Mediterranean experiments failed completely. At Re, Oleron, Le Rochelle, Cancale and Rance there were rapid unexplained declines and these areas were all abandoned. Only at Arcachon was there any sustained success. Arcachon's government parks were still operating in 1865, but even there the natural beds were impoverished, and the fishery was moribund due to inability to collect spat. The overall effect was "the ruin of all hopes based upon oyster culture" by 1870.¹² Some of this decline was probably due to poor site selection in the first rush to expand cultivation, which was understandable given that no one had ever tried this before. Coste was greatly depressed by the success and then failure of his plan. When the experiments failed, he grew despondent and retired from the work, dying shortly thereafter. His colleagues attributed his death to the collapse of his oyster schemes.

Not everyone thought oyster culture would spread as rapidly or easily as Coste predicted. The Ministry of Marine thought restocking would take longer, and they were thus less discouraged by the first wave of failures. They had passed regulations in 1853 mandating a closed season determined by local inspectors. The regulations also reserved natural beds as common property and contained a size limit. The provisions seem to have been designed to protect the natural beds. De Bon noted that the new oyster parks were

¹¹ Ibid. Dean, 1891.

¹² De Bon, 1875. p.893.

mostly dependent on the natural beds for their spat, so the protection afforded to natural beds probably helped later in the revival of cultivation. This revival began at Arcachon, where the initial experiments had lasted longest. The spread of cultivation from there outward was accomplished by private cultivators, not government scientists. They had learned from previous failures and improved their methods. By 1875 oyster farms had again spread to many locations; Arcachon and Morbihan were the two leading centers.¹³

This then was the model that so many U.S. scientists would cite as the way forward. It was an odd choice for a model in some ways. French cultivation depended on higher prices for oysters, as it was more labor intensive. Cultivators had to dig and maintain ponds, and build and work with spat collectors. The French government agency involved, which was a colonial agency too, was also more interventionist than any U.S. agency with authority over oysters. It was more ready to fund a large scale experiment on two scientists' word in the 1850s. Coste's experiments also failed in the short run. Despite all this, the oyster parks Coste inspired were reviving by 1878, and it looked to many like Coste's vision was vindicated.

There was another European U.S. scientists could have chosen to follow. Karl Mobius, one of Europe's leading authorities on the oyster, disagreed with Coste's visions on scientific grounds. Mobius started his career agreeing with Coste though, and his early writings contained optimistic statements about the possibility of oyster culture. When describing his 1869 experiment at Norderney, where he built experimental ponds in the sea flats, he discussed prospects for expanding oyster beds: "All that is necessary, then, in order to increase the size of these beds is to render the sea-bottom between them

¹³ Ibid.

habitable for oysters.”¹⁴ He felt this way despite his experiment ending in failure when the oysters were destroyed by starfish, crabs and storms.

Although Mobius here stated that scientists would learn how to easily expand oyster populations, he soon became less sanguine. His later pessimism stemmed from his idea of the *bioconone*, a word he coined for an interconnected and interdependent assemblage of species and their abiotic environment. He came to feel the tight linkages between species, and between organisms and their environment, forced each species into what ecologists would now call a niche. He thought it was therefore unlikely that a species could expand its range without seriously altering its relationships. Such large changes were usually deleterious. This led Mobius to believe that oyster cultivation had limited potential because oyster populations would be difficult to increase. Trying to increase oysters would upset the balance between organisms and produce unintended consequences, such as not enough food, too many enemies, or declining ecological conditions. He reasoned that undisturbed oyster beds were probably near their population limits already. Depleted areas could be restored, but the optimistic projections offered by Coste and others would never last if they were ever achieved at all.¹⁵

The USFC translated and printed Mobius’ writing on oysters’ bioconone, and they also printed his work on oyster reproductive biology, as he was Europe’s leading authority on the subject in the 1880s. However, I found no instances where U.S. scientists cited his bioconone ideas, whereas they frequently cited him as an authority on reproductive biology and used this latter work extensively. In contrast, Coste was not

¹⁴ Mobius, Karl. 1869. How can the cultivation of oysters, especially on the German coasts, be made permanently profitable? Translated in USFC. 1879. *Report of the Commissioner for 1877*. Washington D.C.: Government Printing Office. pp.874-885.

¹⁵ Mobius, Karl. 1878. The oyster and oyster culture. Translated in USFC. 1883. *Report of the United States Commission of Fish and Fisheries for 1880*. Washington D.C.: Government Printing Office.

only translated and printed, he was described as the father of oyster culture and as a model for American scientists to emulate. The question is why American scientists favored Coste's view and rejected Mobius'.

"Favoring Coste" did not necessarily mean building ponds or spat collectors. Rather, the important distinction between Coste and Mobius was their opinion about the ability of the bays to sustain increasing oyster populations. Mobius thought natural oyster reefs were about as large as they could be, and Coste thought the bays could sustain much larger oyster populations. Both cited anecdotal examples to back up their claims, but neither had proof. Lacking irrefutable evidence, U.S. scientists used other means to choose between these two mutually exclusive intellectual lineages.

5.3 What the scientists did

5.3.1 The race to solve artificial cultivation: 1878-1885

One key reason U.S. scientists followed Coste and not Mobius was their perception that solving the riddle of reproductive biology was the single scientific question that could revolutionize the fishery. Oysters produce a large number larva, only a tiny fraction of which survive. U.S. scientists thought they could keep a much larger portion alive under laboratory and hatchery conditions. This would give them vast quantities of young oysters to restock the bays. All they had to do was learn how to fertilize and rear oysters.

This section of the dissertation describes U.S. oyster science during its "high modernist moment," as it sought to surmount this obstacle, and the important factor to keep in mind is how tantalizingly close a breakthrough seemed. Throughout this period,

scientists continually said they were nearing their goal. Later sections of the chapter take up the revolutionary potential of artificial cultivation, but this section looks at the imagined proximity of success as a key enabling condition.

In the mid-1870's, U.S. scientists did not know whether oysters were hermaphroditic or had separate sexes. European scientists had found that the European oyster was hermaphroditic, and in 1879 William Brooks discovered that America's Eastern Oyster had separate sexes.¹⁶ After determining that oysters had separate sexes, Brooks and others turned to the issue of artificial fertilization, which Brooks saw as the first step toward successful large-scale hatchery propagation.

Brooks was also the first to successfully rear oyster larva in a laboratory. He observed these larvae for twelve days, at which point they died due to fouling of the water. Keeping the larvae's water free from injurious organisms proved to be the key stumbling block to rearing oysters in laboratories. The sea water they needed always contained tiny organisms that preyed upon oyster larvae, and if scientists filtered the water to remove these pests, they would filter out the oyster larvae too.

Brooks' experiment showed that oyster larvae were not simply borne randomly by the current as had always been stated. They were capable of adjusting their vertical position in the water column, and they rose or dropped depending on the water's salinity. This ability helped keep the larvae near the location where they originated. Since freshwater is lighter, freshwater from streams tends to stay on top of the bays, and thus lower salinities are found near the top of the bays. These streams often push surface water out to sea, and so oyster larvae drop when they encounter low salinities. In contrast, they

¹⁶ Brooks, William K. 1879. Abstract of observations upon the artificial fertilization of oyster eggs, and on the embryology of the American Oyster. *American Journal of Science*. Scientists now know Eastern Oysters can change sex with age and environmental conditions.

rise when they encounter higher salinities. Incoming tides generally have higher salinity, so rising when they encounter these pushes them inland, again helping them avoid deep water. Water generally moves out of the bays from the rivers throughout this region, so this simple vertical movement helps keep the larvae from being too easily swept out to sea. Brooks' first experiments thus showed that oyster larvae controlled their drift, determined oysters were separate sexes, and, most importantly succeeded in fertilizing them and rearing them for twelve days. His work was an enormous step forward.

Brooks' experimental success inaugurated a period of intense scientific work aimed to rear oysters in laboratories and hatcheries. In 1878, J. H. Rice, a fellow in natural history at Johns Hopkins, was also trying to artificially cultivate oysters. He was working for the USCGS in the summer at Tangier and Pocomoke sounds. He tried to fertilize oysters in a lab setting, but he procured his oysters from shoal water, and these, he later learned, spawn early and so were no longer useful by the time he collected them. Needless to say he met with failure.¹⁷ In 1879, Brooks moved his work to Crisfield, to obtain better breeding oysters and bay water. At this point he began devoting more of his time to artificially cultivating oysters. At some point Rice came to Crisfield to observe Brooks' experiments.¹⁸

Francis Winslow had been interested in the oyster question since his survey work, and he began experimenting in 1880. He was in Europe working for the USCGS, and he obtained Portuguese oysters for experimental purposes. He succeeded in artificial fertilizing these for the first time.¹⁹

¹⁷ Rice, J. H. 1883. Experiments in oyster propagation. *Forest and Stream* August 9, 21(2): 28-9.

¹⁸ Brooks, William K. 1884. Chesapeake Zoological Laboratory: Report of the Director for its first six years, 1878-1883. Baltimore: Johns Hopkins University.

¹⁹ USFC. 1884. *Report of the Commissioner for 1882*. Washington D.C.: Government Printing Office.

In 1881 the USFC and the State of Maryland began what would become the most important artificial propagation experiments in this period. Maryland leased land at St. Jerome's Creek near the mouth of the Potomac beginning in 1880, and T. B. Ferguson managed this property. The USFC took over the lease and responsibility for it in 1882.²⁰ They wanted a site to replicate and experiment with the French pond culture system.²¹ Ferguson had visited France in 1878 to study pond culture there. At this point, no one had been able to keep oyster embryos alive very long. John Adam Ryder was the chief scientist experimenting at St. Jerome's Creek.²²

In March of 1882 Winslow joined Brooks at Beaufort, Northern Carolina. He thought previous failures to develop eggs were due to lack of oxygen, fouling and lack of food.²³ Winslow provided details on these experiments. One of their key problems was how to obtain sea water for aquaria. They decided they had to provide oxygen, carbonate of lime, and perhaps currents of air or water through the jars. They also noted the importance of food supply for young oysters. The selection of oysters was also key. They had to be breeding, but could not have excess dead sperm, as this polluted the water. Microscopic investigation was needed before selecting oysters, and sometimes they had to use inferior oysters from North Carolina. Many oysters that appeared ready to spawn had eggs that did not develop. This might have been due to oysters not producing ready eggs all at once (it could happen in stages), and Winslow recommended studying the histology of ovaries in detail to settle this. Small amounts of the generative organs could

²⁰ Report upon the station at St. Jerome's, Md., by the Committee of Inquiry, U S. Commission of Fish and Fisheries. Submitted Dec. 24th 1887. Document in the USFC Collection, record group No. 22, National Archives.

²¹ USFC. 1884. *Report of the Commissioner for 1882*. Washington D.C.: Government Printing Office.

²² USFC. 1883. *Report of the Commissioner for 1881*. Washington D.C.: Government Printing Office.

²³ Letter from Francis Winslow to Spencer Baird, March 29, 1882, Spencer Baird collection, National Archives.

be taken out they are enough but care had to be taken not to include parts of other organs. Male organs had to have the sperm washed out immediately, as exposure killed them. Eggs had to be brought into contact with sperm immediately after washing. Winslow recommended using a small number of oysters so that one could attend to detail. Organ fragments had to be thrown away after they settled. Temperature was highly important. When oysters were transferred to water with slightly higher temperature the generative matter deteriorated, however they could be kept in a basket overnight. Segmentation was hastened by high temperatures and slowed by low ones, rapid changes destroyed eggs, and sixty-five to seventy-five degrees was the best temperature. Winslow also described density, currents, aeration, lime, and food. He mentioned the problem of insuforia, which attack oysters, saying nothing could be done really about this. It was difficult at this point to say which factors mattered most. He recommended proceeding slowly and scientifically.²⁴ Winslow's comments show the important of controlling variables and he give a good description of which variables mattered and why.

Once he began working with Brooks, Winslow sent periodic reports to Spencer Baird at the USFC. The first of these discussed how they had been working with no success, the reason for which was "not clear."²⁵ They tested the effects of current and aeration, and found these did not affect spawning. They did discover that adding large amounts of lime sped growth. They also discovered the problem of insofuria (microorganisms that feed on oyster larvae). They found that dead eggs and embryos fed these and increased their number. They said their "ravages...[were] greater than

²⁴ Letters from Francis Winslow to Spencer Baird, June 4 and June 28, 1882.

²⁵ Letter from Francis Winslow to Spencer Baird, June 4, 1882.

expected.”²⁶ At this point they planned to experiment with temperature. Weather had been bad for raising oysters, but their lack of success was due to “something unexplained.”²⁷ Despite this, Winslow wrote that “neither Brooks nor myself despair of eventual success.”²⁸

Subsequent letters from 1882 showed that they never passed this stage. They were able to speed growth, but they never raised young to the attachment stage. Unaided it took oysters from six to thirty-six hours “to complete the segmentation of the egg,” but Winslow and Brooks brought it down to six to ten hours.²⁹ It formerly took six to eight days to reach “advanced stage,” now one to two days were enough. They succeeded in speeding development by adding lime, guarding against insofurina, equalizing temperatures, learning the best specific gravity, and supplying ample food. They reduced insofurina by boiling shells used for lime and by taking great care to remove swimming embryos from the mass of eggs. The best way they found to feed oysters was to insert small amounts of mud from oyster bottoms, but it was hard not to smother the young when they did this, and Winslow thought lack of food was “the probable cause of our failure to meet with complete success.”³⁰

Since they could not keep them alive long enough to attach to collectors, Winslow proposed depositing the unattached young oysters in the water. He proposed going to private grounds in Connecticut to try this. He asked for a letter of introduction to Addison Verrill, a scientist and pupil of Brooks at Yale.³¹ Winslow then proceeded to New Haven

²⁶ Ibid.

²⁷ Ibid.

²⁸ Ibid.

²⁹ Letter from Francis Winslow to Spencer Baird, June 28, 1882.

³⁰ Ibid.

³¹ Ibid.

with a batch of very young oysters. By August he had deposited them on Henry Rowe's planting grounds.³² A letter from Rowe said these were developing well.³³

Meanwhile in 1882, John Ryder was joined by Marshall McDonald at St. Jerome's Creek station. McDonald was the Assistant Commissioner to USFC at this time and an engineer with experience in hatcheries and fishways. McDonald developed an apparatus (a circuit of jars with filters) for keeping water clean in oyster aquaria. This was their major advance this year. It appeared to work well at first. On July 22, 1882, they recorded the first instance of "attachment" (to the sides of their jar) in artificially reared oysters. These surprisingly attached only two hours after fertilization. By twenty hours they had the most advanced embryos ever recorded. These lived for four days, until high water temperature killed them. Ryder and McDonald arranged for well water to run around the jars to keep the temperature lower, but they failed to duplicate their success this year for unknown reasons. Ryder gained information on shell development from this experiment though. At this point he thought the development of the shell was the key to understanding how spat attached themselves.³⁴

Ryder also noted that the question of what oysters eat was important to this work. Opinions differed greatly on this.³⁵ He had done a little work on microscopic organisms in Chesapeake Bay, but he thought scientists needed to know much more about this. His work had suggested these organisms were highly variable. He thought variations in food (probably driven by variations in environmental condition) might account for variability

³² Letter from Francis Winslow to Spencer Baird, August 5, 1882.

³³ Letter from Henry Rowe to Spencer Baird, August 15, 1882.

³⁴ USFC. 1884. *Report of the Commissioner for 1882*. Washington D.C.: Government Printing Office.

³⁵ Ryder, John. 1882. Notes on the breeding, food, and cause of green color in oysters. *Forest and Stream* June 1, 18 (18): 349-51.

in oyster beds' conditions. He said "All of this [is] little touched, and today's students just want to compile lists of new species, so we will likely not know for a while."³⁶

Rice returned to experimenting in 1882 as well. Eugene Blackford provided him with oysters and other material support in a building at New York City's Fulton Street fish market. Rice was able to use a new apparatus he had developed after his initial experiments. This used two siphons to circulate in fresh water and to take old water out. He thought circulation was the key to keeping oyster larvae alive. However, he was unable to keep the flow equal. He then tried using cloth strips as water conduits. These drew water in or out using capillary action, and Rice found he could regulate these much better than siphons by adjusting the size of the cloth strip. Bringing in new water was a key to prevention fouling and insofurina growth. The cloth apparatus worked well, and he was able to keep larvae alive fifteen days. Twelve days had been the former record.³⁷

On July 27, only five days after Ryder and McDonald, Rice saw one of his oysters attach itself to its container. The oyster was two days old at the time. Rice rushed downstairs to tell Blackford who rushed up to try to dislodge it (he was trying to prove that it was really attached). According to their reports, both were jubilant.³⁸ Although they would later learn of Ryder and McDonald's accomplishment, at the time they thought they were the first to reach this important milestone. Just as with Ryder and McDonald, Rice was unable to repeat his success. Both teams reached this stage, but then could not reach it again this year.

³⁶ Ibid. p.351.

³⁷ USFC. 1884. *Report of the Commissioner for 1882*. Washington D.C.: Government Printing Office. Ryder, John A. 1882. Success in oyster culture. *Forest and Stream* September 14, 19 (7): 121.

³⁸ Ibid.

In Europe, Bouchon-Brandely and Adrien Certes were having success as well in 1882. They were able to fertilize eggs of *O. angulata*. There was no difficulty in this, and they formed shells in six to seven days. He made a pond thirty by thirty-five feet long and used a sand filter to admit water. After pouring the larvae into this, spat attached about a month later. They were the first to rear this species in enclosed ponds.³⁹

In 1883, Rice and Blackford continued working in New York City. Rice again saw one of his oysters attach itself, and this time it lived for fourteen days, another record. Rice reached new conclusions after observing this attachment. He learned that oysters attached by thrusting out the velum. No one understood how they attached prior to 1883.⁴⁰

Winslow and Brooks were back in the Chesapeake in 1883, this time at Hampton Roads, Virginia. Winslow delayed writing Baird, hoping this year he and Brooks would succeed. Instead “we have had bad luck and bad luck since the middle of June” and were “unable to secure attachment of the spat. Our first experiments were full of promise.”⁴¹ Toward the end of the summer they did find attached oysters fastened to the glass of their collectors and troughs. But they also lost ground. They had the “greatest trouble, an unaccountable one,” fertilizing eggs.⁴² This was something they managed to do easily the previous year. Later Winslow would explain that this was a poor year for set locally.⁴³ Winslow again mentioned the difficulty of renewing the water without losing the oysters. Brooks had invented, and Johns Hopkins paid for, a set of inclined troughs that trapped

³⁹ Ryder, John. 1882. A summary of recent progress in our knowledge culture, growth and anatomy of the oyster. *Forest and Stream* November 30, 19 (18): 351-2.

⁴⁰ Rice, 1883.

⁴¹ Letter from Francis Winslow to Spencer Baird, August 3, 1883, National Archives.

⁴² Ibid.

⁴³ Letter from Francis Winslow to Spencer Baird, September 13, 1883, National Archives.

oysters and let water flow, like gold pans. The apparatus proved successful in keeping oyster in, but these did not grow for some reason. Captain Waddell (of the Maryland Oyster Commission) assisted them this summer too. At the end of the summer, Winslow proposed going back to Long Island Sound, presumably to check on the last year's experiment.⁴⁴ I do not know if he did this. This year he also asked for information on Ryder's work.⁴⁵

Ryder was now working alone at St. Jerome's Creek. He constructed ponds based on the French claire model. Cloth barriers let water and food in while keeping larger predators out. He introduced fertilized eggs. These not only attached to collectors, they lived and grew. This was the first time artificially fertilized eggs had been successfully grown into mature oysters in the U.S.⁴⁶ The title of Ryder's *Forest and Stream* article explaining this breakthrough was "The Oyster Problem Solved."⁴⁷ He was aided by the Eastern Shore Oyster Company in his work this year.

1883 proved to be a major year in European oyster science too. Huxley gave a famous speech before the Royal Institution of London on the oyster question.⁴⁸ P. P. C. Hock published "De Voortplantingsorganen van de Oester," which Ryder called "the best contribution from Europe to oyster anatomy in thirty years."⁴⁹ It also had the most up to date bibliography on European oysters and oyster culture.

In 1884, encouraged by his success, Ryder built a more extensive pond system (five ponds) at St. Jerome's Creek. He was joined by another scientist this year, W. de C.

⁴⁴ Letter from Francis Winslow to Spencer Baird, August 3, 1883, National Archives.

⁴⁵ Letter from Francis Winslow to Theodore Gill, September 20, 1883, National Archives.

⁴⁶ USFC. 1883. *Bulletin of the USFC*, Vol.3. Washington D.C.: Government Printing Office. pp.281-294.

⁴⁷ Ryder, John. 1883. The Oyster Problem Solved. *Forest and Stream*, August 30, 21 (5): 90.

⁴⁸ Huxley Thomas. 1883. Oysters and the Oyster Question. *English Illustrated Magazine* (1883-84): 47-55.

⁴⁹ USFC. 1885. *Report of the Commissioner for 1883*. Washington D.C.: Government Printing Office.

Ravenel. They were able once again make artificially fertilized spat attach to collectors in these ponds. They did best in ponds with ample circulation. Other scientists also set up two ponds at Woods Hole this year, although no sources mention who this was. Winslow and Brooks were discouraged by their lack of success the previous year and they stopped experimenting.⁵⁰ Rice died this year, ending the New York experiments.

Ryder and Ravenel continued experimenting with pond culture in 1885. In their forty square foot pond, Ryder placed one hundred bushels of oysters, and in a four hundred foot canal he placed twelve hundred bushels of shells in four hundred collectors. They estimated the oysters produced one hundred billion fry, and “this vast multitude of oysters will be wafted back and forth through the shells 360 times during the season, thus insuring the fixation of the largest possible percentage of embryos.”⁵¹ By this time they had constructed twenty spat collecting apparatus in the ponds.

Ryder’s reports and articles on his 1885 work claimed his findings would revolutionize the industry. He wrote that “[t]he hope that I might solve, or help to solve, the oyster-problem practically, has served to constantly encourage me for the five years that I have been working with that object in view.”⁵² In an article titled “The Oyster Problem Actually Solved” he stated that “the future of the oyster industry in the South is henceforth ensured.”⁵³ He admitted that most of his previous work, and that of others, was faulty, but now he could see why they failed and thus knew how to succeed. His principal findings were that spat would attach at any level, they did not need rough surfaces, only clean ones, spat raised by artificial fertilization would attach to collectors

⁵⁰ USFC. 1886. *Report of the Commissioner for 1884*. Washington D.C.: Government Printing Office.

⁵¹ Ryder, John. 1885. A new system of oyster culture. *Science*, Vol.6 (147): 465-467.

⁵² Ibid. p.465.

⁵³ Ryder, John. 1885. The oyster problem actually solved. *Forest and Stream* October 22, 25 (18): 249-50.

in ponds, sixty-five to eighty degrees was best for attachment, and oysters' food occurred naturally in the water.⁵⁴ By the end of 1885, Ryder was not only convinced pond culture could work, but also that he had completely solved the oyster problem. Convinced his work was finished, Ryder left Maryland and moved on to other things. He worked on oyster greening and anatomy, but he never experimented with artificial cultivation again.

Ferguson and Ravenel tried to keep cultivation going at St. Jerome's Creek, but sediment and slime completely ruined the 1886 season.⁵⁵ Whether this was due to Ryder's absence (he continually stressed the importance of circulation) or bad luck is unknown. Since pond culture was difficult, Ferguson decided to cultivate on a larger scale outside the ponds. He placed spat collectors in the main pond's connecting canal. The canal was two hundred feet, and zigzagged to create more area. The *Fish Hawk's* crew came to dig a bigger pond and sink a new well, but the ground was too hard and the pipe found no water.⁵⁶

Lack of any positive results in 1886 led the USFC to curtail experiments at St. Jerome's Creek in 1887. It was placed under the supervision of a watchman. Someone (no sources say who) did smaller experiments, and the result was that naturally fertilized oysters grew better in ponds than artificially fertilized ones. Neither grew well enough to make pond culture commercially viable. The USFC commissioned a report on the station this year too. It recommended keeping it open, as the ponds were already built, but the station was closed in 1889.⁵⁷

⁵⁴ USFC. 1887. *Report of the Commissioner for 1885*. Washington D.C.: Government Printing Office.

⁵⁵ USFC. 1888. *Report of the Commissioner for 1886*. Washington D.C.: Government Printing Office.

⁵⁶ Report upon the station at St. Jerome's, Md., by the Committee of Inquiry, U S. Commission of Fish and Fisheries. Submitted Dec. 24th 1887. USFC collection, National Archives, record group 22.

⁵⁷ Ibid.

The closing of St. Jerome's Creek station marked the end of the first period of U.S. oyster science. After Brooks' initial experiments, 1878-1885 saw a period of intense work on the artificial fertilization and attachment of oysters. One is struck when reading the sources at the sense of expectation. Success always seemed close but elusive. There was also a pattern of successfully reaching a certain stage, only to be unable to repeat the results, usually for unknown reasons. By 1886 scientists realized the challenge of artificial cultivation was too formidable, although in Ryder's case he thought he solved the problem, and they largely stopped trying.

5.3.2 Post-1885 work on artificial cultivation

After 1885, references to artificial cultivation experiments appeared sporadically. Blackford went to Cold Springs Harbor, New York in the summer of 1892 to work on this. The state legislature had asked him to attempt to repeat the experiments from Fulton Market. He had a canal dug to connect the station's two ponds to the ocean so that he could propagate oysters and salt water fish. He began by placing mussel shells and then oyster embryos into one of the ponds. Spat settled on these from nearby spawning oyster beds. However, he had trouble getting new water to circulate in; the water temperature in the ponds was constantly shifting and this killed all the young oysters. Water from a nearby marsh also leaked in through a pipe and covered the next batch in slime. In general his report and work seemed much less rigorous than other scientists. He was trying to prove pond culture could work, but compared to the other scientists his methods were less rigorous and realistic. He offered no conclusions from the work.⁵⁸

⁵⁸ Blackford, Eugene. 1893. The propagation and natural history of the American Oyster: experiments at Cold Springs Harbor, L. I., by the New York State Fish Commission. *Fishing Gazette* January 5.

In the 1890s, two other scientists took up artificial cultivation experiments. One was H. F. Moore. In 1898 Moore was experimenting with clare ponds, without any success, in Lynnhaven, Virginia. The other was Julius Nelson. Nelson, who worked extensively on oyster natural history, was appointed Biologist at Rutgers University after earning his Ph.D. under Brooks in 1888. Most of his papers from these years were destroyed in a 1903 fire, so it is difficult to document his early work on oysters. Remaining records show that he worked on egg fertilization in 1901, and embryo development in 1902.⁵⁹ By 1903, Nelson was occupied with getting embryos to live into the shell stage in number. At this point he saw this as the key hurdle, and also a problem that would take years to solve, especially owing to the difficulties encountered in the field and lab. Nelson worked on artificial cultivation throughout his career, but his writing never showed the sense of optimism and hopefulness of earlier authors. Instead, he continually stressed how long it would take to achieve success and how important small steps were to this process.

In 1903 he built two clare ponds, and went into detail about the difficulty keeping fry in and still getting their food in too. He was conducting hundreds of experiments a year in artificial fertilization. These include using a microscope to determine sex, and mixing eggs and sperm in sea water. He thought he was close to solving the problem of spat survival and he was beginning to move towards “the question of spat fixation...which is the crucial and culminating question in this work.”⁶⁰ He planned to focus on this in summer of 1904.

⁵⁹ Julius Nelson papers, Rutgers University, Alexander Library special collections.

⁶⁰ New Jersey Oyster Commission. 1903. *Report of the New Jersey State Oyster Commission*.

In 1904 Nelson worked on methods for collecting, feeding larvae, and providing good growing conditions. The long term issue he was working on was figuring out what conditions were best for attachment. He noted that the USFC conducted “extensive” experiments this year near Long Island, but I could find no notes on this in the USFC files. From 1904-1916 Nelson continued to work on cultivation but published no articles or reports on his progress. He worked at Keyport, Oceanic, and Navesink (all in New Jersey) during these later years, and also studied oyster beds on Prince Edwards Island, Canada.⁶¹

In 1905 Moore resumed experimenting, this time in Louisiana in the winter of 1905/06, and continued into winter 1908/09. These were no longer artificial cultivation experiments. Instead, they were experiments with planting seed oysters and using spat collectors. In 1908 Moore mentions that scientists still knew little about oysters’ food. They knew what it was and how they ingested it, but it was only in the last three years that they had been able to measure it in an approximate way in the water. There was no good data at all on this; attempts have been made to study this, but Moore said they had been unsatisfactory.⁶²

There were planters who took a keen interest in the scientists’ work. For example, Henry Rowe contributed two articles to the Bulletin of the USFC, and in his speeches and papers he demonstrated an up to date understanding of scientific knowledge.⁶³ Rowe was probably exceptional though, and even if he was not, there was little the scientists did that planters could use directly.

⁶¹ Julius Nelson papers, Rutgers University, Alexander Library special collections.

⁶² USFC. 1910. *Report of the Commissioner for 1908*. Washington D.C.: Government Printing Office.

⁶³ Rowe, Henry C. 1893. Deep water oyster culture. Vol. 13, *Bulletin of the United States Fish Commission*, No. 13. Washington, D.C.: Government Printing Office. Rowe, Henry C. 1910. The wholesomeness of

5.4 What scientists said

This section uses Abbott's *System of Professions* to understand the rhetoric of the first oyster scientists.⁶⁴ Abbott begins by saying professions must be seen as organized in a system within which they vie for "jurisdiction." By jurisdiction, Abbott means different professional groups gain legitimacy to take action within a certain area. A profession competes for jurisdiction by defining a problem they seek to address, and then articulating the specialized solution that they are better positioned to supply than their competitors. Scientists often defined the problem of the oyster fishery and offered solutions. For the most part, they did so in broadly similar ways. The following two subsections describe their statements about the fishery's problems and their scientific solutions.

5.4.1 Problem Definition

Almost all oyster scientists agreed that oysters were declining, or had declined in the past. McDonald's first sentence in his 1880 report read: "The fact that there has been a great decrease in the annual product and in the value of our fisheries is too patent to require demonstration."⁶⁵ Similarly, Brooks opened a speech printed in the *Baltimore Sun* saying "[t]here has not been anywhere exhibited in the United States a more reckless squandering of natural wealth" and that everyone knew this.⁶⁶ He was emphatic that

oysters as food. Vol. 28, *Bulletin of the United States Fish Commission*. Washington D.C.: Government Printing Office.

⁶⁴ Abbott, 1988.

⁶⁵ McDonald, Marshal. 1880. *Report upon the oysters and fisheries of tidewater Virginia*. Richmond: R.F. Walker., p.7.

⁶⁶ *Baltimore Sun*, November 15, 1883.

oysters only had five to ten years left.⁶⁷ Many other scientists predicted eminent exhaustion of Chesapeake beds.

The only example of a scientist who did not believe in decline comes from a single article in the *Fishing Gazette* from Joseph W. Collins, a USFC scientist, who said Chesapeake Bay oysters were inexhaustible.⁶⁸ Collins article was the lone piece of evidence where a scientist opposes the standard narrative of decline or endangerment. His article indicated that scientists were not completely unified and it raised the question of how many scientists thought this way. One possibility was that Collins was not expressing his true views; he was trying to curry favor with Chesapeake tongers. Another possibility is that scientists who did think this way felt hesitant to express their views in print. Marshall McDonald and Hugh Smith, who led the USFC between 1888-1895 and 1895-1915 respectively, were enthusiastic advocates of private oyster culture. Since evidence is missing for most of the scientists, although coverage of the most important ones is good, this remains a distinct possibility.

One possible explanation for oyster decline was changing environmental conditions. Several scientists said this was a common view. Scientists repeatedly rejected it. Sometimes they listed the various environmental causes supposed to have caused declines, and then refuted these in turn. More often they simply lumped them together and stated they were false without explicit refutation. Instead of natural causes, they laid the blame on overfishing. However, they discussed overfishing as a symptom of a more important underlying cause.

⁶⁷ Ibid.

⁶⁸ Collins, Joseph. 1893. Opening of the Oyster Season. *Fishing Gazette*, January 5.

Scientists tended to portray this underlying cause in similar ways. The larger narrative that emerged from these statements was one that explained oyster decline as part of a historical process. Fishermen managed oysters as a commons at first, which may mean they did not manage them at all, or it may mean they had an archaic sort of local management, but either way this was inappropriate for the modern world. Technological and population changes rendered it obsolete. McDonald said this was the history of fisheries everywhere in the world.⁶⁹ These historical explanations implied a law-like quality to the development of fisheries and resource management in general. They were the same basic ideas expressed by many commissioners in their role as legislative advisors (see chapter four).

Private property emerged as the cornerstone of progress because of the incentives that it created. This narrative of course rested on a particular view of motivations. One would not invest energy into improving one's resources if one could not claim the fruits of one's labors, and thus there was no incentive to improve a resource without private property. Oysters declined because without improvement, harvesting could not keep pace with increasing demand. This part of the narrative depended on the assumption that someone would take the improved resource from the one who has improved it. According to this view, "strange as it may seem, the efforts of those most directly interested and dependent upon the oyster industry were mainly directed in a selfish struggle to be the first in a race of destruction."⁷⁰ These arguments closely follow the logic Garrett Hardin describes as the "Tragedy of the Commons."⁷¹

⁶⁹ McDonald, 1880.

⁷⁰ Ellyson, Taylor J. 1894. *Proceedings of the convention called to consider and discuss the oyster question*. Richmond. p.25.

⁷¹ Hardin, 1968.

Tradition emerged as a barrier to progress in this narrative. Because people became used to one way of doing things, exercising a right to common property in wild produce of the sea, they were slow to change and failed to reform their behavior. They were “killing the goose that laid the golden egg” and were “suspicious of any attempt at improvement.”⁷² Fishermen looked at artificial cultivation, which was progressive and modern, “doubtfully...with disdained curiosity,” and resented all effort to restrict their “prerogative to capture the very last fish in our waters.”⁷³ This “prerogative” not only caused overfishing, but also created opposition to cultivation. As Nelson put it:

This [cultivation] is never done under conditions of a free or public fishery. It is in the interest of conservation that oyster farming be introduced to supplement natural production. The foremost difficulty encountered in this connection is the opposition of those who believe in harvesting what nature produces without contributing to the labor of cultivation.⁷⁴

The traditional system was also seen as parochial because of its local scale of management. McDonald said, “The whole industry then [1880] was regarded as a purely local interest, and no view which did not measure down to the narrow personal views of those directly concerned in it, could pass through the doors of that committee and have consideration in the legislature.”⁷⁵

Scientists sometimes said that traditional management had disposed oystermen to think highly of the natural beds’ productivity, making them feel that preserving these would provide prosperity. However, scientists regularly remarked that this was wrong. Preserving natural beds required restricting supply (i.e., harvesting less), which raised

⁷² Winslow in Ellyson, 1894, p.28.

⁷³ McDonald, 1880.

⁷⁴ New Jersey Oyster Commission. 1903. *Report of the New Jersey State Oyster Commission*. p.17.

⁷⁵ McDonald in Ellyson, 1894. p.30.

demand and undid protective efforts.⁷⁶ Caswell Grave, in a speech titled “How to Save Maryland’s Oyster Industry,” said the main lesson Maryland needed to learn was that restoring the public beds would not be enough. He went on to strongly recommend leasing areas classified as natural beds but lacking oysters (i.e., barren bottoms).⁷⁷

This narrative historicized the problems with tradition. It tied local management practices back into the larger picture of resource management’s inevitable evolution. But while resource management history followed a law-like progression, any one industry could unfold in a number of ways. The oyster industry was thus at a crossroads. It could continue toward exhaustion, or embrace progressive methods, with science leading the way. Brooks explained this choice: “We live in a highly civilized age, and if we fail to grasp its spirit we shall go to the wall before the oyster cultivators of the Northern States, just as surely as the Indians have been exterminated by the whites.”⁷⁸ The northern cultivators Brooks had in mind were the large Connecticut planters who he feared would outcompete Maryland oystermen.

Scientists did write things that made them seem less unified than the basic outline of their ideas suggests. For instance, Brooks favored prohibiting dredging on natural beds, and saw their maintenance as essential for preserving the seed supply.⁷⁹ Many scientists agreed. Most did not want to see natural beds eliminated, and like Brooks, they did not mind keeping these as commons. McDonald expressed similar views, saying “spat-producing oyster beds...of course should be preserved for all time and under State administration and regulation, since, where they are in sufficient numbers and suitably

⁷⁶ Winslow in Ellyson, 1894. p.27.

⁷⁷ Grave, Caswell. 1909. How to Save Maryland’s Oyster Industry. *Oystermen and Fishermen* Volume 6, No. 10.

⁷⁸ Maryland Oyster Commission. 1884. *Report of the Oyster Commission of the State of Maryland*. p.31.

⁷⁹ *Baltimore Sun*, November, 15, 1883.

distributed, they present an inexpensive means of maintaining the oyster supply.”⁸⁰

According to Brooks, these areas needed a cooperative organization of oyster fishermen devoted to improving the beds. If they could not form one, then it would be better to privatize the natural beds. Belding and Nelson also said oystermen need cooperative organizations to improve their common beds.⁸¹ Brooks also thought oyster planting did not require much capital, and could be profitable on a small scale, although it did “need constant and intelligent attention.”⁸²

Scientists’ descriptions of past management practices varied in their sophistication as well. Belding acknowledged that common property was not the same as open access, and he had detailed, firsthand knowledge of Massachusetts town-based oyster management.⁸³ Oddly, few scientists cited illegal dredging as an important cause of decline, despite constant complaints about this from oystermen in the Chesapeake newspapers. McDonald also said “the object of public fish culture, is to assure the utmost utilization of the resources of our waters,” but in regulating fisheries, lawmakers must be careful not to “embarrass or harass” fishermen with undue regulations.⁸⁴

Nelson’s report on Prince Edward Island’s oyster fishery, written at the end of his career, is a good example of a more nuanced view that still adheres to the larger narrative. He blamed decline on over-fishing and counters many natural cause theories. No one on the island was practicing conservation because of fishermen’s attitudes, and these were based on lack of familiarity with planting. Nelson stated that on private farms self-interest

⁸⁰ Letter from Marshall McDonald to Daniel Colt Gillman, n.d. Marshall McDonald papers, Virginia Historical Society.

⁸¹ Belding, 1909. Nelson, 1915, draft of Prince Edward Island study, personal papers.

⁸² Brooks, 1891. p.127.

⁸³ Belding, 1909.

⁸⁴ Letter from Marshall McDonald, recipient and date unknown, National Archives.

equals the public good, whereas the opposite was true on public beds. Canadian oyster laws were good, but did not do enough. Closed seasons helped, but were probably not effective. Closing depleted beds was not effective since they lacked spat and cultch. Natural beds and areas suitable for cultivation were nearly alike biologically. Fishermen were able to establish this and legally take planters oysters, but this should not be the case. He noted that fishermen did not want public beds privatized because they were afraid they would be taken over by capitalists. He acknowledged that this is part of the struggle between capital and labor, but saw greater control by capitalists as inevitable. All of this fits the basic narrative, but in the end he expressed sympathy for the difficult transition the tongers must undergo. Nelson saw an inevitable pattern, one that would improve sustainability, but he recognized that progress is unfair.⁸⁵

5.4.2 Solution Definition

Abbott says that professions need coherent definitions of problems, and oyster scientists' narrative provided that.⁸⁶ Professional groups must also legitimize their attempts to address the problem by defining their specialized approach and skills. Scientists' approach and skills involved the application of natural science. However, what role could natural science play if private property rights were the key to progress? How could studying oyster embryos institute privatization? Oyster scientists came at this question from two converging angles.

First, scientists could lay the basis for an improved oyster fishery. One day, when oystermen accepted private property, the fishery would progress and productivity would

⁸⁵ Nelson, 1915.

⁸⁶ Abbott, 1988.

increase. Oyster planters would be ready and eager to receive the latest knowledge from scientists. In particular they would want the increased spat from artificial cultivation. Thus scientists saw themselves as aiding progress by finding way to increase production through experimentation. Of course, oyster planters could conduct some types of experiments themselves. But scientists argued that they could make more progress because they were engaged in pure science, from which more of the really important gains would come, and had training and knowledge planters lacked.

While this was the main narrative, there was another role for scientists. This was running fish (and oyster) hatcheries. Scientists would experiment with the best ways to propagate fish, but after they learned this their jobs were basically managerial. They saw this as part of their role because no one else would do it. Individual fishermen would not build a hatchery since everyone else would have access to the fish once they were returned to the water. Oysters were different as they did not move around once placed in the water (as long as they were over the larval stage), and so the cultivator could plausibly defend a claim to them. However, artificial cultivation was technically complicated and so scientists were still needed to conduct the experiments that would get the industry over this step. They would experiment with propagation of fish and oysters, but while the state would have to run fish hatcheries permanently, private oystermen would one day propagate their own oysters. Thus Winslow said:

In view of the rapid deterioration of the oyster beds it appears advisable that all information, regarding the life and habits of the oyster, that can be obtained should be [illegible] speedily and made public for the benefit of the oyster culturists, as that class must in a short while increase and need what we may in a measure be able to supply.⁸⁷

⁸⁷ Letter from Francis Winslow to Spencer Baird, July 18, 1882.

Ryder felt his pond system was for use “upon areas which are positively and absolutely under individual, proprietary control.”⁸⁸ These were common examples and illustrate how scientists’ work aimed to benefit planting by putting it on a scientific footing, especially through artificial cultivation.

Winslow’s quote also shows a different role scientists advocated for themselves: educational specialists. Someone had to educate oystermen, who needed to overcome their prejudice toward private property, and who needed, if they were planters, to know the most efficient methods. Brooks had, for twenty years, been engaged in “the attempt to teach the people of Maryland the necessity of supplementing the bounty of Nature with the industry of man,” and he thought the Chesapeake needed “a whole army of skilled instructors.”⁸⁹ Nelson agreed with Brooks on the scale of this project, saying that it took years of education to teach oyster fishermen the benefits of planting.⁹⁰ This was a role similar to that of agricultural extension agents.

Scientists could educate by writing articles and speaking to oystermen, thereby slowly changing public opinion, and although many scientists did see this as part of their job and did it frequently, it was not a role for science itself. It did not explain what scientific knowledge production could contribute to problem of common property and the need to expand cultivation. As in agricultural extension again, education depended on demonstration. As scientists conducted experiments to benefit planting, it would become increasingly attractive to non-planting oystermen. They would see what scientists were doing, and observing the increase in planting productivity they would gravitate toward “progress.” Successful natural science would be the best form of persuasion. As

⁸⁸ Ryder, 1885a.

⁸⁹ Brooks in Ellyson, 1894. p.31.

⁹⁰ Nelson, 1915.

McDonald put it, “retrograde” methods of dealing with oyster industry are unlikely “now that public attention has been called to it.”⁹¹ He tied this to the evolutionary narrative saying, “as the planting interest expand under the present conditions the disposition will also become more general to contract the public areas to such a point as to reserve only spat-producing oyster beds.”⁹² At a meeting called by the Richmond Chamber of Commerce to initiate a public education campaign, Winslow said oystermen were “suspicious of any attempt at improvement” and “they also suppose to know what is best for them. That they do not makes no difference.”⁹³ He went to say no one could force change on oystermen, but once educated they would adopt these cultivation readily. He discussed at length how French scientists played this role at the outset of European oyster culture.

This educational role depended on the same ideas about human nature contained in the scientists’ vision of a progressive evolutionary history. That narrative assumed a universal, predictable, rational human nature. Applying this to education, scientists said that once oystermen saw the scientific truth of progress, they would inevitably adopt modern practices. In this way, natural scientists were conducting their own type of visibility project. They would educate oystermen by making “progress” visible. But scientists were more than just educators of the provincial; their discoveries would make nature visible, affording greater control and productivity.

The goal of making nature visible raised another matter related to scientists’ professional definition: should they focus on pure or applied science? Most saw their

⁹¹ Letter from Marshall McDonald to J. B. Baylor, November 28, 1892, National Archives.

⁹² Letter from Marshall McDonald to Daniel Colt Gillman, n.d. Marshall McDonald papers, Virginia Historical Society.

⁹³ Winslow in Ellyson, 1894, p.28.

work as combining both. As McDonald put it, “scientific investigation, however remote it may seem to be from immediate economic application, is the only sure foundation upon which to build the practical methods of fish culture...Practical fish culture and scientific inquiry must go hand in hand.”⁹⁴ Scientists were discovering new facts about oyster life history, while simultaneously contributing to their conservation. Natural history knowledge was seen as the foundation for successful propagation. A letter from McDonald to Goode, himself a proponent of the value of pure science, said it is important for people “representing the broader side of the Fish Commission work” to stay in touch with “the practical man.”⁹⁵ He is becoming “more and more intolerant of views that are shaped purely by selfish and utilitarian aims.”⁹⁶ Scientific research was the true and only end of the commission, but fishermen “and average fish culturist” saw this as valueless.⁹⁷

Scientists articulated different views about what sort of pure science would be best. Most early studies were driven by the need to understand reproductive biology, or else they were applied hatchery experiments. Both aimed at contributing to conservation by expanding planting through artificial cultivation. Nelson stated that the best method was to study “natural history and physiology (ecology or biology) of oyster development.”⁹⁸ Ryder thought finer questions of oyster embryo anatomy would likely not help cultivation and that studying what oysters ate was just as important.⁹⁹

Scientists saw their knowledge production as playing a key role in rationalizing the industry by making it more like farming. They thought they could learn new things

⁹⁴ Letter from Marshall McDonald to Daniel Colt Gillman, n.d. Marshall McDonald papers, Virginia Historical Society.

⁹⁵ Letter from Marshall McDonald to George Brown Goode, May 11, 1889. National Archives.

⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ New Jersey Oyster Commission. 1903. *Report of the New Jersey State Oyster Commission*. p.17.

⁹⁹ Ryder, 1882a.

about oyster biology and this could serve as the basis for a more rational approach to oystering. The main way this would work would be by studying oyster reproductive biology, which would unlock the keys to artificial cultivation.

The rationale for government involvement in hatcheries was clear enough that it was never questioned in these sources. Scientists were needed to find the most efficient way to propagate fish. They argued that private individuals would never do this, as the fish they grew would be caught by others. The state would have to manage hatcheries. Scientists might not need to stay involved after they had perfected propagation, but the stage where technicians could take over was obviously not at hand in the 1880s.

If the need for scientists to work on hatchery propagation seemed convincing, the rationale for natural science knowledge production for other purposes was less clear. Should natural scientists restrict themselves to studies aimed at aiding artificial propagation? No one but them was studying shad embryos and salmon diets, but why did anyone need to do this in the first place, and why did they need scarce tax dollars to do it? Again and again the scientists did discuss and explain why money was indeed needed, and they almost always cast the answer in terms of rationalizing management. Past fishery management was seen as antiquated and bound to fail as populations and demand rose. The question then was how to improve fishery management. This would necessarily depend on the fishery in question, even though some generalities might stand out. What they agreed was needed was better information. Without this, rational management could not proceed. Natural science would supply the same type of knowledge production as the survey work. Making nature visible was the key to rationalizing its use. Fishery scientists were the individuals and group best suited for this task.

This did not quite answer the question though. It merely restated the need for science leading to better propagation, if that was the way to rationalize fisheries management. However, hatcheries were not the only solution. Life history knowledge could help determine where and when fish spawned, thereby helping management. Scientists would argue that seemingly “pure” science was needed too, as it helped improve management by expanding the knowledge base. Although studies on the histology or embryology of oysters might seem less significant than studies testing propagation apparatus, the former might prove more useful in the long run.

There is little direct evidence of pressure on scientists to produce applied instead of pure science. A series of letters from Julius Nelson to the New Jersey Shellfish Commission show some of the funding difficulties scientists faced. Nelson wrote in 1903 that “[o]ur laboratories and other appliances are not much to brag on; it could not be otherwise with only \$200 per season for all expenses, food, travel, apparatus, and such matters as pertain to the establishment of such a station.” He then asked for \$1,000, saying that last summer’s experiments were promising (he crossed out “successful”), and he now at a “very critical point in their investigations.”¹⁰⁰ Nelson wrote asking for money for a lab boat the following year, saying it would be helpful if he could move his experiments to places where spat was setting well.¹⁰¹ Two letters in 1905 and 1906 were strongly worded and Nelson was upset over lack of money. He complained about having to take the time to write reports for Charles Bacon, the head of New Jersey’s Shellfish Commission, saying that he was only furnishing the report because he was legally required to do so. He also complained that his budget had been reduced. Nelson stated

¹⁰⁰ Letter from Julius Nelson to Charles Bacon, September 3, 1903.

¹⁰¹ Letter from Julius Nelson to Charles Bacon, nd, 1904.

that he had decided to dedicate the remainder of his life's work to oyster culture but the state was not helping adequately.¹⁰² In 1907, Nelson's tone changed. He had received money for his houseboat laboratory and his letter was pleasant.¹⁰³ However, it took Nelson a few years to actually buy the boat, and his papers contain several letters to state senators asking for money (see figure 5.2 for a picture of the laboratory houseboat).¹⁰⁴ Bacon was a leading proponent of utilizing oyster science in management. As head of the National Association of Shellfish Commissioners he invited many scientists to speak at their annual meetings. Nelson attended almost all of these. Bacon mostly likely withheld funding because he had none to give. His speeches at the NASC meetings continually blamed state legislators for not supporting scientific management. The Nelson case shows a leading scientist having to argue for funding, and although he cautioned against optimistic appraisal of the progress science could make, he was always asking for money for applied science.

Another line of evidence comes from the USFC correspondences, which frequently discussed the merits of pure and applied science. In a letter asking Brooks to solicit Congressional support, McDonald wrote that proper administration of the USFC depended on seeing the importance of both pure science and fish culture. He went on to say, "[p]ractical fish culture and scientific inquiry must go hand in hand."¹⁰⁵ In a letter to Goode, McDonald wrote that it was important that Goode and others were "representing the broader side of the Fish Commission work," and McDonald was becoming "more and more intolerant of views that are shaped purely by selfish and utilitarian aims." He wrote

¹⁰² Letters from Julius Nelson to Charles Bacon, nd, 1905 and 1906.

¹⁰³ Letter from Julius Nelson to Charles Bacon, nd, 1907.

¹⁰⁴ Letters from Julius Nelson, 1908 and 1909.

¹⁰⁵ Letter from Marshall McDonald to William Brooks, May 19, 1892. National Archives.

that scientific research was the true and only end of the commission, but fishermen “and average fish culturist” saw this as having no value.¹⁰⁶ These letters indicate that public opinion favored tangible benefits from the USFC, and USFC scientists wanted to make their patrons in government and private sector see the importance and usefulness of pure science. A letter from Blackford makes this point from a utilitarian perspective.

Blackford wrote about “the importance of throwing the entire strength of the Fish Commission into the improvement of our fisheries.” He stated that the USFC’s supporters want to see more results than what the commission’s scientists have produced so far. Blackford wrote that “[s]cientific inquiry and collection of specimens should be made entirely subsidiary to the practical work of the Commission.”¹⁰⁷ The need to produce tangible results pushed the USFC toward fish culture.¹⁰⁸ By the 1910s, when Hugh Smith (a fish culturist) replaced Marshall McDonald (a fishway engineer and fish culturist), the primacy of applied science was well-established. Smith wrote a letter to Gilbert H. Grosvenor, head of the National Geographic Society, had asked him to speak to the Society in the winter of 1915-6. Smith said he would be happy to publicize the commission’s work. The talk would be titled “Farming the Waters,” and it would provide an account of the activities of the federal government in maintaining and improving the supply of useful animals in the interior and coastal waters of the United States.¹⁰⁹

5.4.3 Role of science and professionalism

¹⁰⁶ Letter from Marshall McDonald to George Brown Goode, May 11, 1889. National Archives.

¹⁰⁷ Letter from Eugene Blackford to Marshall McDonald, Jan 7, 1888. National Archives.

¹⁰⁸ Allard Jr., 1978.

¹⁰⁹ Letter from Hugh Smith to Gilbert H. Grosvenor, October 27, 1915. National Archives.

Another place where scientists discussed their definition of their task was in letters related to professional conflicts. In these scientists used a particular definition of their role as a criterion for professional advancement. They wrote that only rigorous scientists should advance to top spots in the USFC, and they extended this criterion to deciding whose research to support as well. That the USFC's heads would only want to promote rigorous scientists is unsurprising. What is more interesting is their definition of a "rigorous scientist." These letters offer an important window into the scientific qualities they valued and why they valued them.

Interpreting these letters requires caution because they deal with touchy issues of professional jockeying, loyalty, and promotion. In some instances, it is difficult to tell if a writer is telling the truth or just trying to align himself with someone. In one case, a writer is clearly lying, as he wrote different things to different people. But the way they used scientific values remains the same throughout.

This image revolves around one familiar idea: scientists should be, above all, "disinterested." They should pursue science with the goal of providing knowledge for the public good. In contrast to this stands the "spoilsman," who uses political appointment for personal gain. The recurring fear in these letters was that elected officials would appoint people to head the USFC and state commission as favors for political aid, and these people would then use the commissions' resources to line the pockets of political allies via contracts and further appointments.

Science, in this telling, emerged not just as something that could help provide knowledge about nature, knowledge that would one day bring about great advances in the fisheries, but it also functioned as a criterion to identify and weed out corruption and

political favoritism. Porter shows that quantification played the same role in government agencies more generally.¹¹⁰ Agencies had to quantify costs and benefits to show that their programs were providing the greatest good of the greatest number compared to competing programs. Competition over funds and a drive to squelch corruption led to a situation where important decisions had to be justified by objective measures.

Fishery scientists at this time never tried to quantify scientific merit. They used the concept of “disinterestedness” instead. The question was how to prove or see disinterestedness. In the early USFC’s scientific work, this seems to have been done by personal knowledge. If a person’s work was suspect, word seems to have gotten around, and many of these letters attempt to convey just this sort of impression.

This is yet another way science could make things visible. The exacting qualities of laboratory and field work would expose the spoilsman in an undeniable way. At least this was the ideal. There could, of course, be corrupt scientists, or scientists with strong political views. In fact, as documented above, the key natural scientists were anything but “disinterested” in the politics of the oyster questions. They tended to hold strong views on class conflict that directed their scientific labors down paths with political consequences. Science created a rational form of visibility, one that seemed universal and disinterested, and yet depended on personal contacts and impressions. Scientists’ concept of disinterestedness co-existed with and was used to further a scientific program with large political consequences.

And yet, they successfully used this criterion to defend their top posts from the influence of corruption. No one could accuse Marshall McDonald of using his post for personal gain; he even asked Spencer Baird for a raise, saying he had “money

¹¹⁰ Porter, 1995.

worries.”¹¹¹ In retrospect, their scientific criterion was better than the alternative they feared. Keeping the USFC’s top officials free from the “spoils system” helped their credibility with the fishing industry and state governments. It was also necessary to maintain a sense of shared mission and continuity among the scientists.

“Disinterestedness” may have been a personal, cultural value posing as an objective measure, but it functioned much as if it really were objective. This was another example of using science as a standard of value that measured disinterested motivations, or motivations toward the public good and away from self-interest or other motives. This was similar to how oystermen used science in determining boundary lines in surveys. It became a criterion for selecting people. It forced them to faithfully represent the natural world, and this meant they could not skew these for other interests, at least that was the ideal.

Before discussing the content of the correspondences on corruption and careerism in the USFC, it is important to note that most of these were found in McDonald’s letters. McDonald was trained as an engineer and military officer, not as a natural scientist. His appointment to the head of the USFC reflected hatcheries’ importance and the desire for applied science to lead the agency. His interest in using science as the criterion for promotion may have been partly due to his need to seem more scientific, to show scientists he would uphold their values. However, regardless of the timing of these letters, the content reflects an important use of science.

Typical of these letters was one from 1892 where McDonald wrote to Brooks that “a lame person...without much scientific knowledge” was trying to get appointed

¹¹¹ Letter from Marshall McDonald to Spencer Baird, January 9, 1882. National Archives.

commissioner.¹¹² He thanked Brooks for voicing his views to the President, who he said needed to hear from scientists. McDonald went on to say Addison Verrill had sent him “a very fussee letter” saying scientific men saw his administration as a failure because he stopped paying Verrill. McDonald claimed Verrill failed to render services promised and “behaves like a spoilt child.”¹¹³ The same letter showed McDonald extolling the importance of the commission’s scientific work, but indicated that at least some scientists thought he was failing in this regard. There is not enough evidence left to tell who really thought what. What is more important about these two letters, and all the rest too, is that everyone agreed on a certain role science should play (at least they agree with this in their written statements).

This role for science came to light most prominently in letters about the professional ambitions of Fred Mather, Eugene Blackford and T.B. Ferguson. Mather was the superintendent of the New York State Commission for Fish and Game Commission’s Cold Springs Harbor hatcheries in part of the 1880s and 1890s, where he propagated trout and other fish. As described before, he first experimented with artificial cultivation of oysters at New York’s Fulton fish market in the summers of 1882 and 1883. He was asked to duplicate these at Cold Springs Harbor in the summer of 1892. He built ponds and attempted to get oysters to attach to spat collectors in these, without success.

Based on his description, his studies were haphazard, and they were never published by the USFC. Despite this, he also held a position as Assistant to the USFC. In a letter to McDonald he mentioned that he had “struggled hard to keep the characters

¹¹² Letter from Marshall McDonald to William Brooks, May 19, 1892. National Archives.

¹¹³ Ibid.

apart.”¹¹⁴ He apparently had ambitions to move up in the USFC, once writing that Baird had promised to promote him, and he had hoped to eventually win appointment as the next Commissioner. Since he was not promoted, he was thinking of leaving fish culture, “as it held little for a man of ambition.”¹¹⁵ The same letter alluded to other offers and sounded like he was trying to leverage promotion. Blackford referred to Mather’s professional jockeying in one of his letters, saying “I don’t know what ails the man, except that he has a big head on him.”¹¹⁶ Other scientists sometimes referred to Mather’s scientific work in disparaging terms. McDonald answered Mather courteously in all his correspondences, but when writing to others he said Mather was “base” and he wanted to drop the USFC’s connection to Cold Springs Harbor. Eventually he stopped answering Mather’s letters altogether. A few other scientists, such as Ryder, expressed similar views about working with Mather.

There seem to have been two reasons why other scientists disliked Mather. One was his political ambitions. Another reason may have been his lack of scientific training. He had no formal training as a scientist, although he had been involved in fish hatchery work for the USFC since 1872, and was Superintendent of the New York State Fish Commission from 1883 to 1895.¹¹⁷ He lived for ten years in the Western U.S., and had worked as an editor for *American Field* and *Forest and Stream*.¹¹⁸ There was a sense of personal antipathy in several letters about Mather, so another possibility is they simply disliked him due to his personality. Probably these all mattered. However, his careerism

¹¹⁴ Letter from Fred Mather to Marshall McDonald, January 26, 1892. National Archives.

¹¹⁵ Ibid.

¹¹⁶ Letter from Eugene Blackford to Marshall McDonald, January 26, 1892. National Archives.

¹¹⁷ *New York Times*, February 15, 1900.

¹¹⁸ *Fishing Gazette*, April 12, 1894.

combined with lack of scientific training and accomplishments seem to have been the heart of the matter.

The New York Commission was particularly prone to this sort of problem, or at least there is more evidence of this kind for it. The governor vetoed funding for two new hatcheries in 1892, saying they were being built for political reasons, and that three of the five existing state hatcheries were poorly located due to political manipulation.¹¹⁹ Not only was the state's chief oyster culturist suspect, but Eugene Blackford was also the subject of several letters that evoked the same scientific criteria.

Blackford's case is more complex though. Mather distrusted him, writing to McDonald that when he propagated salmon for the USFC at Cold Springs Harbor, Blackford "interfered, and you know the result."¹²⁰ He felt Blackford and the state commission were trying to "step in and claim credit for work it ridiculed years ago."¹²¹ Blackford had other enemies too. Seth Green, the first U.S. scientist to experiment with fish propagation, tried to have Blackford removed from the Commission as early as 1885.¹²² Blackford was attacked for conflict of interest, since he owned a fish wholesale business.¹²³ Eventually he was removed. Blackford claimed this was because he supported the Republican candidate who lost the election.¹²⁴ He also said Mather had something to do with this and that the New York Commission had become "a political machine."¹²⁵ No one left there was "disinterested." He later characterized the man who replaced him (Huntington) as "totally lacking in a number of things that go to make a

¹¹⁹ *Fishing Gazette*, January 5, 1893.

¹²⁰ Letter from Fred Mather to Marshall McDonald, January 26, 1892. National Archives.

¹²¹ *Ibid.*

¹²² Letter from Eugene Blackford to Marshall McDonald, December 7, 1885. National Archives.

¹²³ Letter from Eugene Blackford to Marshall McDonald, January 5, 1891. National Archives.

¹²⁴ Letter from Eugene Blackford to Marshall McDonald, January 26, 1892. National Archives.

¹²⁵ *Ibid.*

gentleman,” and said he could not cooperate with him on the New York Commission’s contribution to World’s Fair.¹²⁶ He went on to say a circular from Huntington announcing a fishery congress was “wild and asinine” because it claimed coastal fish were declining, and made fishermen laugh and was obviously not true. Blackford had “no use for him...he is a boor and does not know when he gets courteous treatment.”¹²⁷ Blackford also wrote a letter to McDonald where he discussed the need to keep the fish commissions clear from strictly political appointments. In this letter he expressed approval for Goode’s appointment to head the USFC on those grounds, and wished Goode would reconsider and stay in charge permanently.¹²⁸

It is not clear how McDonald, the recipient of these letters, felt about Blackford. He claimed to be “highly indignant” at Blackford’s firing in 1892,¹²⁹ and Blackford wrote him a letter asking for his support in 1885.¹³⁰ However, in 1889, Ryder wrote to McDonald and said Blackford was trying to take his job. He wrote “I have absolutely no faith in Blackford, but all faith in you. I think it simply outrageous to make the office the prey of spoilsmen.”¹³¹ Ryder said he would use the Philadelphia Academy of Science to support him. In a later letter, McDonald thanked Ryder for his support, but replied that he thought Ryder was mistaken about Blackford’s ambitions.¹³² Ryder had received a letter from Collins (another USFC scientist) informing him of Blackford’s plans. Later Ryder recommended Collins to McDonald as an ally, saying he “can thoroughly depend” on

¹²⁶ Letter from Eugene Blackford to Marshall McDonald, January 28, 1893. National Archives.

¹²⁷ Letter from Eugene Blackford to Marshall McDonald, December 1, 1893. National Archives.

¹²⁸ Letter from Eugene Blackford to Marshall McDonald, October 15, 1887. National Archives.

¹²⁹ Letter from Marshall McDonald to Eugene Blackford, January 24, 1892. National Archives.

¹³⁰ Letter from Eugene Blackford to Marshall McDonald, December 7, 1885. National Archives.

¹³¹ Letter from John Ryder to Marshall McDonald, March 11, 1889. National Archives.

¹³² Letter from Marshall McDonald to John Ryder, March 18, 1892. National Archives.

him. Ryder himself wanted to keep out of public life, writing that “university bickerings are enough for me.”¹³³

Although it seems that Blackford was trying to aid the fishery, it is impossible to know for sure which scientists, if any, were being fully honest in these letters. Despite their ambiguity, these letters show that people were competing over appointments and some of these were given as political rewards. The language used to discuss this is clear enough too. Would be employees were divided into “spoilsmen” and “scientists.”

A more straightforward use of science as a professional criterion comes from Virginia. T. B. Ferguson was Commissioner of the Virginia Fish Commission and also worked for the USFC as an Assistant Commissioner. Other scientists often opposed him, claiming he was unscientific and mainly interested in career advancement. Blackford wrote McDonald letters saying that Ferguson wanted to succeed Goode: “The man we have to fear is Major Ferguson, and needs to be watched. Anything I can do here to thwart him, you may rely upon.”¹³⁴ When the U.S. Senate was debating buying Battery Island for a hatchery, Blackford wrote that this was Ferguson’s way to get a “convenient ducking ground.”¹³⁵ He asked to be kept informed about his movements and offered to “open fire on him from several quarters.”¹³⁶

Another example of Ferguson’s reputation concerned his aborted attempt at an 1884 oyster survey. The USFC loaned him the *Fish Hawk*, but the captain, Lieutenant Wood, who commanded the *Fish Hawk* for much of this period, refused to work with him. In a letter to the Secretary of the Navy, Wood wrote

¹³³ Letter from John Ryder to Marshall McDonald, August 14, 1892. National Archives.

¹³⁴ Letter from Eugene Blackford to Marshall McDonald, December 21, 1887. National Archives.

¹³⁵ Letter from Eugene Blackford to Marshall McDonald, August 4, 1888. National Archives.

¹³⁶ Ibid.

I cannot with self respect, again consent to be placed under the immediate authority of Mr. T. B. Ferguson...as past experience has taught me that he uses the Fish Commission and the Naval forces connected with it, on every possible occasion, to further his private ends.¹³⁷

He sent a copy to Baird as well. When the Secretary of the Navy replied that he must follow orders, Wood found ways to disrupt the survey. He ran the ship aground surveying in water he knew was too shallow, he put in for coal at ports unnecessarily distant, he sent down a diver to survey oysters as a way to slow the process of sampling beds, and generally made every effort to ruin the survey without evading the letter of his orders. Ferguson eventually gave up, saying “the work so far has been a complete failure and a useless expenditure of time and money.”¹³⁸

Ferguson’s case seems clear, but the others were more ambiguous. What stands out in all of them is the fear of turning the commission appointments into political rewards. Scientific production could stand as a way to guard against this, as it could prevent men like Mather and Ferguson from qualifying. However, identifying good scientists seems to have rested on personal judgment and communication.

5.4.5 Scientists’ models

The models in this section were not mathematical, but instead were models of success scientists pointed to when justifying their own approach. Perhaps the most common model scientists cited to explain why science and the industry should move towards planting was actually a metaphor: farming. Scientists would compare oysters and migratory fish, and pointing out that oysters stayed in place, they would say this made oystering closer to farming or stock raising than fishing. Migratory fish should remain a

¹³⁷ Letter from Lieut. Wood to W. E. Chandler, October 30, 1884. National Archives.

¹³⁸ Letter from T. B. Ferguson to Spencer Baird, “Report of Oyster Investigation”, n.d. National Archives.

commons, but oysters should not. They would then compare them to various crops.

Potato comparisons were particularly numerous for some reason. McDonald asked what would happen if wheat fields were commons?¹³⁹ Brooks compared gathering fruits and berries (a commons) to modern farming (on private property), and cited the difference in productivity.¹⁴⁰ This basic shift in productivity of farming was seen as going hand in hand with private property and the incentives it created, and this was the basic way scientists used the farming metaphor. This metaphor was widely used by the commissioners as well.

In the 1870s, European scientific articles on oysters outnumbered their U.S. counterparts. These included both pure and applied science. U.S. scientists frequently cited these studies, especially those from France. France served as a key model for early U.S. scientists working on the oyster problem. Scientists continually praised Coste in particular, which was all the more odd as his experiments failed. Coste attributed this to lack of support, and U.S. scientists must have agreed. Their basic message was that Coste had shown the way with his pioneering studies. Ryder hoped he could introduce French methods and better them. In the U.S., artificial cultivation should allow planters to dispense with tile collectors, as “The older methods are universally cumbrous.”¹⁴¹ Labor was too expensive for this in the U.S. Nelson wrote that he expected New Jersey salt marshes to eventually be drained and used as *claire ponds*, as in France.¹⁴² Winslow said French government science was a great benefit because people were stirred up. Not only

¹³⁹ Ibid. p.30.

¹⁴⁰ Ibid. p.31.

¹⁴¹ Ryder, 1882a.

¹⁴² New Jersey Oyster Commission. 1903. *Report of the New Jersey State Oyster Commission*. p.16.

did he suggest following Coste's scientific path, but he also suggested using science to demonstrate progress in the same way Coste wanted too.¹⁴³

In general, this narrative of praise for Coste was very common in early oyster scientists' writing. Mobius' warnings were never cited in any source I have uncovered, despite his works being translated and reprinted by USFC scientists. Mobius was cited frequently when scientists discussed oyster anatomy, and they referred to him as a great authority on oysters. But despite their evident appreciation for his science, they ignored his prescriptions.

Connecticut and Rhode Island were continuously cited as successful models. Planting was expanding there in the 1880s and 1890s, and scientists cited this as evidence for the need to expand it elsewhere. Brooks compared this to Virginia and Maryland's current "nearsighted" policy in an 1884 speech, saying these states had a large and influential body of fishermen who had always used the natural beds and would resist planting as long as any oysters remained on these.¹⁴⁴ Connecticut was often compared to less farsighted places in this way. Connecticut's success was a ubiquitous feature of scientists' writing.

The USFC was originally founded to study fish and fisheries; hatcheries were not part of its agenda. However, the American Fish Cultural Association urged Congress to give the USFC money to experiment with propagation, and this quickly grew into the most extensive branch of the Commission's work in terms of money and men.¹⁴⁵ By 1880, the German carp had been raised successfully in hatcheries and distributed to

¹⁴³ Winslow, Francis. 1885. The North Carolina oyster industry. *Forest and Stream* May 7, 24 (15): 292-3 and May 14, 24 (16): 332.

¹⁴⁴ *Baltimore Sun*, October 22, 1884.

¹⁴⁵ Allard Jr., 1978. Taylor, Joseph E. 1998. Making salmon: The political economy of fisheries science and the road not taken. *Journal of the History of Science* 31: 33-59.

nearly every state and territory. Salmon and shad were also successfully restocked in rivers where they had been depleted.¹⁴⁶

5.4.6 Optimism

Environmental historians have noted the optimism of Progressive Era natural resource scientists, sometimes citing this as a major reason they developed plans that altered the environment in way that proved unsustainable.¹⁴⁷ Plans to turn the whole Chesapeake into a giant oyster farm fit this model. In general, scientists were highly optimistic at first about their ability to transform the industry by expanding knowledge.

Even Mobius, eventually the most pessimistic scientist, started off with sanguine hopes. He described his 1869 experiment at Norderney, where he built ponds in the sea flats. These were hit by starfish, crabs and storms that destroyed them. He claimed that to expand beds “All that is necessary, then, in order to increase the size of these beds is to render the sea-bottom between them habitable for oysters.”¹⁴⁸ What changed his mind was the opening of a canal between the North Sea and the Baltic. The North Sea fauna did poorly in Baltic waters, and this led him to begin questioning the idea of unlimited oyster expansion.¹⁴⁹

In the U.S., optimism was the norm. Ryder said “The hope that I might solve, or help to solve, the oyster-problem practically, has served to constantly encourage me for the five years that I have been working with that object in view.”¹⁵⁰ He made similar

¹⁴⁶ Towle, Jerry C. 2000. Authored ecosystems: Livingston Stone and the transformation of California fisheries. *Environmental History* 5 (1): 54-74. Evenden, 2004.

¹⁴⁷ Langston, 1995.

¹⁴⁸ Mobius, 1883. p.25.

¹⁴⁹ Ibid.

¹⁵⁰ Ryder, 1885a.

statements, such as “The uncertainty which had hitherto attended oysterculture must disappear in the face of intelligent experiment.”¹⁵¹ Brooks was optimistic too at first, writing:

I have been able to carry the oyster much further than anyone has ever done before with the American oyster, and I have met with no difficulty that seems to be insuperable. The subject is one that requires very delicate management, and the difficulties are much greater than I had anticipated, but I feel confident that all that is now needed is proper apparatus, and that *the question demands nothing but a little patience and ingenuity.* (italics in the original)¹⁵²

He felt Chesapeake Bay should be able to raise 400,000,000 bushels a year (its maximum output was been probably around 20 million). Winslow remarked “neither Brooks nor myself despair of eventual success.”¹⁵³ Brooks said, discussing his Hampton, Virginia experiments, “I feel though, that I have command of the subject.”¹⁵⁴ Brooks also wrote that “I have been able to carry the oyster much further than anyone has ever done before with the American oyster, and I have met with no difficulty that seems to be insuperable.”¹⁵⁵

Why were scientists initially so optimistic? One reason may be a self-selection process. The way scientists were defining their role meant that if someone wanted to work with them they probably had to agree in the optimistic direction they advocated. Scientists who felt more pessimistic about expansion of planting would likely have taken their career in a different direction. The scientists who were starting work at this time had to convince supporters they could get results, so they could not afford to be pessimistic. If

¹⁵¹ Ryder, 1882a.

¹⁵² *Baltimore Sun*, September 6, 1882.

¹⁵³ Letter from Francis Winslow to Spencer Baird, 1882, National Archives.

¹⁵⁴ *Baltimore Sun*, May 28, 1883.

¹⁵⁵ *Baltimore Sun*, September 9, 1882.

they had, someone else would have taken their place. It is hard to see how the science could have started down any other path.

This explanation makes sense, but it is difficult to support with evidence. It is also incomplete. Another part of the explanation for optimism has to come from scientists' lack of knowledge. Lacking evidence to the contrary, why not be optimistic? True, the scientists did have Coste's failure and Mobius' warnings, but these may look more noteworthy now than they did then. At the time, these had to be balanced against subsequent success in France, Connecticut and hatcheries. The ecological side-effects of expanded cultivation (such as starfish invasions) and hatcheries (such as the detrimental effects of carp) had not yet come fully to light. But all of these comprised anecdotal evidence, not actually scientific knowledge of the conditions governing success and failure.

One of the key pieces of missing evidence was food. During this time sciences did not know exactly what oysters ate. They thought it was probably tiny plants, but they had no idea how abundant these were. Brooks provided an interesting view of the state of scientists' knowledge in 1894. He compared the Chesapeake to the Nile, saying both were hugely fertile, but the former was suitable for one crop only: oysters. Just as the Nile drained an immense area and carries fertile silt, so the Chesapeake does as well. That this silt is underwater makes no difference. These nutrients feed tiny marine plants. Although he had no idea how to quantify their population, he described vast concentrations of these and the speed of their growth. Oysters were especially fit to turn tiny marine organisms into human food.

The fitness of the oyster for this work-bringing back to us the mineral wealth which the rivers steal from our hillsides and meadows-is so complete and admirable, so

marvelous and instructive, that it cannot be comprehended in its complete significance without a thorough knowledge of the anatomy and embryology of the oyster.¹⁵⁶

The great river valleys are the cradles of civilization, and the Chesapeake is one of these. “Man will some time assert his dominion over the fishes of the sea and will learn to send out flocks and herds of domesticated marine animals to pasture and fatten upon the vegetable life of the ocean.”¹⁵⁷ This speech shows Brooks’ optimism, and it shows how it was based on colorful analogy, native pride, and hopeful expectations rather than scientific evidence.

Nelson was optimistic too, but expressed more reservation than any other scientist in this period, perhaps because he started working after the failure of the first wave of studies. He was at Johns Hopkins at the end of these. In explaining his hesitance about cultivation he said, the “one hitch in all this beautiful arrangement” was that the time and cost of labor and supplies made artificial cultivation unprofitable.¹⁵⁸ Another example of his measured thinking comes from a few articles from New Jersey and New York newspapers. These praised his work, saying he was nearing an important breakthrough. Nelson responded to these by saying successful oyster culture was still many years distant and he wished to avoid raising false hopes. One exchange with the *New Jersey Courier* was especially interesting. The paper wrote that “His most recent efforts...have been crowned with the success he has sought so persistently, and it looks as though the problem of “seed” is practically solved.”¹⁵⁹ The paper’s editor was instrumental in procuring funds for Nelson’s first coastal lab and the same experiments described in the

¹⁵⁶ Brooks in Ellyson, 1894, p.37.

¹⁵⁷ Ibid. p.36.

¹⁵⁸ Nelson, Julius. 1889. *Oyster interests of New Jersey, New Jersey Agricultural College Experiment Station. Special Bulletin E.* New Brunswick. p.37.

¹⁵⁹ *New Jersey Courier*, October 15, 1903.

article, yet Nelson still wanted to keep expectations realistic. He replied the following week, saying he felt he has made “encouraging progress” but had not solved the seed problem. He did not want exaggeration or resulting disappointments. He thanked the editor for agitating a discussion and getting things started.¹⁶⁰

All of the above discussion misses the personality of the scientists. There is some evidence for this, at least for a few of the principal scientists, especially Ryder and Nelson. In Nelson’s case, understanding how he thought about science requires knowing something about his religious views. There is evidence for these in three speeches collected in his papers, titled “A Half Century of Darwinism,” “Sex and Health,” and “Relation of Biology to Theology.”¹⁶¹ In each, he explained the correspondence between religion and science. Citing Henry Drummond’s *Natural Laws in the Spiritual World*, Nelson said “There is profound agreement rather than superficial disagreement between Darwinism and the Gospels,” and “Bible students should earnestly seek to study natural sciences.”¹⁶² The crux of these speeches was that the laws of nature flow from God, just as the laws governing human conduct are found in the Bible. Nature’s law was the equivalent to a third testament; therefore natural science taught one how to live morally.

Nelson never explicitly applied this logic to oyster cultivation. But the consistency and completeness of these arguments in his public lectures offer convincing proof that these were ideas that informed his view of biology as a profession. Nelson probably saw his work with oyster propagation and spat collection as uncovering laws of nature that would yield a better industry, but not just a more rational one. He also thought

¹⁶⁰ *New Jersey Courier*, November 5, 1903.

¹⁶¹ Nelson, Julius, n.d. “A Half Century of Darwinism,” “Sex and Health,” and “Relation of Biology to Theology”. Julius Nelson papers, Rutgers University, Alexander Library special collections.

¹⁶² Nelson, “Relation of Biology to Theology.”

his work would create a more moral industry. It would help eliminate waste and increase production, but more importantly, over time it would lessen conflict among different oyster classes. Cultivation was part of a better physical, social and moral order, and science would help light the way. This combination of science and social order shows the importance of “co-production” in oyster science.

In a telling section of “A Half Century of Darwinism,” Nelson discussed the need for scientists to lead social reform.

Human health was evolved under the natural conditions of savage and animal ancestry. Now man is subjected to the new environment of civilization and its luxuries, its artificial surroundings and its strains. The question is will he adapt himself or will he become extinct [as ancient civilizations]....Only an expert Darwinian is competent to debate such questions.¹⁶³

One can see how this would apply to the oyster industry. It worked fine in the past, but under modern civilizations pressures, oystermen must adapt or become extinct. Only an expert scientist can uncover God’s laws of nature, and show the way forward.

None of this implies optimism however. It does express a clear role for science, but uncovering God’s plan in nature was not necessarily easy. Indeed, if it required expert Darwinians, then this implies a high degree of difficulty. Nelson’s religious views seem to have tempered his optimism in comparison to his contemporaries, but it supported a similar role for scientists as guides.

Ryder, by contrast, was probably the most optimistic scientist of all. The small amount of personal material hints at why this was the case. As with Nelson, this was best illustrated by his views toward evolution. He was looking for a theory of evolution that did not contain natural selection, and he thought he found one in 1874. He called it the “dynamics of phylogeny.” The subject appealed to his sense of the scope of his ability:

¹⁶³ Nelson, “A Half Century of Darwinism.”

“Here is field enough for a Darwin. I almost shrink from the task when I consider its magnitude...It completes Darwin’s work on a far grander scale than Darwin ever dreamed of.”¹⁶⁴ Ryder, who published 278 papers in his short lifetime, went on to describe his flash of insight, saying,

I sat up late last night after the whole thing flashed across my mind in an instant, and did not sleep for two hours after I went to bed because my brain was going like a dynamo...Wolfe and Schwann mark two eras in the history of hypothesis. I shall mark a third if I live to complete the sketch of the vast hypothesis...My disappointments vanish into the uttermost inane when I think of what it has been possible for me to achieve.¹⁶⁵

He then dropped the subject, and did not openly discuss it again, which his biographer finds hard to understand. The main point to note is his expanded sense of purpose and ability. Another quote on his evolutionary theory shows the same views:

It is my hope to reduce the doctrine of evolution into a simple realization of Newtonian principles. The three great Newtonian laws of motion are at the bottom of the whole matter. Some day I shall be able to tell a great deal that I have kept to myself in order to test its truth....I have at least worked out a new theory of inheritance which must ultimately replace those of Weismann and Darwin, or at least furnish the foundation by which the data and phenomena of variation can be co-ordinated with the great universal principle of the conservation of energy.¹⁶⁶

These quotes make it easier to understand his involvement in oyster science. There was a short period of intense activity, and then his revelation that he had solved the problem of the industry completely, then an abrupt switch to other concerns. His optimism flowed from his expansive belief in his own ability.

In conclusion, optimism played a role in Progressive conservationists’ approach to oyster science. The sources of this optimism are not always evident, but lack of data on food supply was an important factor; it was a condition that allowed optimism to exist.

¹⁶⁴ Harrison, Allen. 1896. A biographical sketch of John Adam Ryder. *Proceedings of the Academy of Natural Sciences of Philadelphia*. Philadelphia: University of Pennsylvania. p.232-233.

¹⁶⁵ Ibid. p.234.

¹⁶⁶ Ibid. p.236.

The only two scientists with biographical information to explain their attitude are Nelson and Ryder. Their cases are different, and this suggests scientists were optimistic for idiosyncratic reasons. It may have been that, for professional or institutional reasons, only the optimists pursued conservation science, but they arrived at their optimism by very different, personal routes.

5.5 Discussion: an ethnography of efficiency

This section looks at Hull's "enabling conditions" to better understand how and why scientists adopted Scoot's high modernist views. In oyster science, there were two rival views from Europe's leading specialists, one of which, Coste's, was thoroughly high modernist, and other, Mobius', was much more cautionary. The question is why scientists chose to follow Coste, and Hull notes that this is the most important question for historians of science.¹⁶⁷ Hull also says historians have trouble answering this question due to lack of data, and instead advises scholars to look for "enabling conditions." Hull also advises tracking "intellectual lineages" to do this. The question then is what were the enabling conditions that led scientists to follow the high modernist intellectual lineage of Coste and not the cautionary ecology of Mobius?

One standard answer is that increasing production through science de-politicized political issues about resource use. In other words, the idea that the application of science, for the first time, could increase production offered a solution that was politically palatable to legislatures funding science and commissions. The classic example of this from the Progressive Era was the Scientific Management movement.¹⁶⁸ Fish hatcheries

¹⁶⁷ Hull, 1988.

¹⁶⁸ Merkle, 1980.

fit this model exactly. Legislatures preferred fish hatcheries as a solution to the contentious conflicts between fishermen and dam builders, conflicts that pitted artisanal resource users with traditional rights against wealthy industrialists. This was the larger cultural context of this time period and it was important for oyster science as well.

Langston shows that the U.S. Forest Service operated with narrow production maximizing goals too, but for different reasons than high modernist ideals.¹⁶⁹ She notes that the first foresters in the Blue Mountains had ecologically oriented notions and wanted to develop locally applicable knowledge for sophisticated harvesting regimens, but they quickly shifted to more narrow goals due to the complexity of the forest and because of political pressure for results. Langston's case shows how natural complexity shaped scientists' professional role. Mobius' ideas lacked immediate applicability to the oyster crisis, and accumulating information on relationships between species and other environmental variables would have been much more time consuming than trying to find the key to successful lab-based cultivation. Scientists also at first lacked evidence on how hard this latter option would be, which rapidly accumulated. Scientists described pressure for practical results much like Langston's foresters too, and this helped steer them away from the time consuming studies Mobius' model suggested.

Abbott describes the need to define a solution to a legislative audience and the general public, which was divided in the case of tongers and planters.¹⁷⁰ Scientists defined their special solution as using science to aid and guide the industry, and this was in response to a definition of the oyster problem as a major crisis. Science was to provide

¹⁶⁹ Langston, 1995.

¹⁷⁰ Abbott, 1988.

guidance by making things visible. Science made three things visible in this professional definition: reproduction, progress, and corruption.

Reproduction seemed like a simple lynchpin for many scientists. If increasing production was a narrow goal, understanding reproductive biology was a narrow way to accomplish this. It ignored oyster food supply, and ignored Mobius' warning that this would limit production, just as it ignored his other warning about the unintended consequences that would follow increasing one organism's population in a *bioconone*. It failed due to difficulties in the lab, but if it had succeeded, it is unlikely oysters could have become much more numerous than they already were. Connecticut and Rhode Island were the states that increased their oyster production through planting, and both suffered the classic problem of monocropping agriculture. Their beds were hit with starfish infestations that dramatically dropped production. Two leading promoters of planting, Henry Rowe and Victor Coste, eventually gave up on oyster planting because of this type of problem, retiring and dying depressed at the failure of their grand schemes.

Making progress visible to the public was done via the colonial enclosure and improvement narrative and the colonial technology comparison.¹⁷¹ As in colonial cases overseas, these ideas led scientists to devalue local knowledge and practices and to overlook their potential contribution to effective management. The colonial ideas showed "progress" in a law-like way based on stark comparisons of property and technology. Scientists argued they could support this vision of progress best by unlocking the secret of artificial cultivation. It was this narrow view of progress that led them to focus on increasing production. It was not only politically feasible, it fit their cultural predispositions. It is important to note that there was an alternative (Mobius), but this did

¹⁷¹ Drayton, 2000. Adas, 1989.

not lead to greater planting, in fact it tended to limit it, so it was rejected. Coste's ideas fit scientists' preconceptions about property and technology, whereas Mobius' recommendations were silent on these issues. Seeing increased production as the public good was the same ethical simplification seen in the last chapter, and once again the unintended consequences would have been increased wage labor and loss of independence. This narrow, high modernist, vision of the public good had its roots in these idealized colonial comparisons.

Science was to serve as a guide to progress too. Scientists felt that when they perfected artificial cultivation, the results would be so obvious and stunning that everyone would see its desirability and adopt the new methods. This was the educational side of co-production. Scientists tried to produce knowledge that would shape oystermen and legislators' ideas and attitudes.

Science also played a role in dealing with corruption. Using it as a professional criterion was a form of simplification again, because scientists were using it as a shorthand way to identify "disinterestedness," as Porter shows.¹⁷² But this was a useful role potentially. It depended on other norms though. Scientists had a professional culture that was needed to actually determine and apply this criterion. Scott says that when simplified schemes worked they did so because they were supported by pre-existing diversity. This is the same pattern as what happened in scientists' use of "science" as a criterion for professional advancement in the commissions.

¹⁷² Porter, 1995.

Chapter six: mapping planters' property

6.1 Introduction: oyster lease mapping and cultural studies of cartography

Planting grew from the early 1800s, and planting property evolved as well. Planters and tongers fought over space, and compromised by dividing bays, leaving natural beds for tongers and all other areas for planters. Planters then needed rights to areas they were using. In many cases they claimed these areas without formal title, often putting stakes into the bay to mark their oysters. The states and towns began leasing these planting grounds in many areas. Tongers routinely violated leases for a number of reasons. Sometimes they claimed it was on natural bed, or they took oysters out of dislike of leases on principle. Both stemmed from cultural attitudes toward bay commons, but they also pointed to the difficulty of accurately marking aquatic property and expanding the property institutions of land to the sea. As planting grew, so did these problems, and these were a major impetus for state legislatures to found oyster commissions. The commissioners' main response was to put property on a more orderly footing by producing another kind of new knowledge: accurate property maps. This chapter examines this process of cadastral surveying and the next examines the mapping of natural beds. The current chapter looks at how this new process encoded the traditional values of the planters and their compromise with the tongers.

This cadastral surveying process departs from Scott's model due to the nature of the property and resource use in question. Scott's cases tend to focus on complex systems of property rights, such as agro-forestry systems, where multiple individuals have overlapping rights. Such systems are harder to map than oyster planting, where one person has right to plant one crop (oysters) in one area. The oyster case was similar in

some respects though, one of which was in the difficulty the state had in accurately mapping underwater property. Compounding this inherent difficulty was resistance from planters. Much of this was due to their not wanting to pay taxes, or to a distrust of the new agencies, but eventually the surveyors completed their work. Despite many planters' ambivalence, these surveys should be seen as putting planters' traditional property rights into an administrative form. Their ability to do so, in spite of the centralization of knowledge they required, was made possible by the relatively simple set of property rights the state was mapping.

6.2 Rationalizing property: Rhode Island and Connecticut

6.2.1 Pre-commission planting maps

Early reports on the Rhode Island's and Connecticut's property surveys describe the irregular way leasing was done before the commissions. The Rhode Island legislature made oyster grants to specific individuals for oyster planting in 1798, 1822 and 1827. Following the U.S. Supreme Court's ruling in *Martin v. Waddell*, Rhode Island passed its Oyster Act in 1844 setting up a commission to oversee leasing.¹ Planting and leasing expanded after this. An 1864 law sought to improve the commission's administration, and the first extant report followed this. The new commissioner, John P. Knowles, deplored the commission's "chaotic condition."² He could not tell how lease fees were spent, as:

the loose memoranda (not books) which came into my hands from my predecessors yield no information upon this point; nor, it may be added, any reliable information as to who of the leasees of oyster beds had paid rents, or who were in default; or as to who were, in fact, the holders and owners of outstanding leases; or how many or

¹ Rice, 2006. p.25.

² Knowles, 1864. p.1.

which leases apparently outstanding in full force, had been, in an equitable view, surrendered or cancelled by the action or inaction of the Commissioners.³

Knowles granted twenty-nine new leases in 1864, bringing the total to one hundred forty-two, but he had trouble obtaining rent from some of these, saying they were “suspected to be of the genus *skulker*, with whom, by the way, patience shall cease to be a virtue” (italics in the original).⁴ Lessees were required to submit a report of their harvest total, and about half of them did, but many did not know they needed to do this, and others paid for leases but did not use them because they were waiting for starfish to lessen before opening planting businesses.

After Knowles there are no state reports on leasing until Rhode Island attempted to improve their commission again in the 1880s. Administration was still haphazard in 1880. In 1881, the commissioners complained that there was nowhere to put lease maps; they had so little funding that they had to buy a portable desk to store these. It had to be portable because they had no office. The commissioners hired a private firm to survey planted beds in 1881. This survey showed many people occupying space illegally, most of which they decided to add to their leases. Rhode Island’s leasing was disorganized at first, but was rapidly modernized in the early 1880s, and by leaving large areas for tongers, it seems to have generated little conflict after this.

The commission stated that a major concern in this process was to protect the “free fishermen” by not leasing places where the public would derive as much benefit as lessees.⁵ This included natural beds and room around these for oysters to shift naturally, and the commission had the ability to change natural bed boundaries as they moved. The

³ Ibid. p.2.

⁴ Ibid. p.2.

⁵ Rhode Island Shell Fish Commission. 1900. *Annual Report of the Commissioners of Shell Fisheries*.

commission claimed it was trying to be as generous as possible to natural bed tongers in assigning leases. This led them to exempt much area. For example, six hundred acres of proposed leases were rejected in 1899, at a time when only around three thousand acres had been leased.⁶ This generous protection was extended in 1901, when the law was revised so that all land covered by less than four feet of water remained public, even though much of it was suitable for planting and never had natural beds. Rhode Island could afford to adopt this liberal definition in part because so much of Narraganset Bay was deep underwater land open for planting. In addition, the success of deep water cultivation in neighboring Connecticut led cultivators in Rhode Island to focus in deeper areas too. A last factor was the strong opposition to leasing in these traditionally public areas.

Connecticut's commission also strove to maintain the older property dispensation. The commissioners' first task was determining the line that divided town from state jurisdiction. They held meetings with town selectmen and claimed these went well. The 1881 act gave "considerable latitude for interpretation" to town jurisdiction, and the commissioners gave towns what they wanted to secure support.⁷ Most tonging beds were in town waters, and by giving much power to town governments in this process the commission was maintaining the older way of managing oysters.

Their reports, like Rhode Island's, show the state of mapping and leasing before 1880. Most lines between towns were already settled, although a few were unclear, and town lines were generally known by landmarks. For example, one town border was set at "a point whence the outer beacon bears halfway between the brick chimneys of Wheeler

⁶ Ibid.

⁷ Connecticut Shell Fisheries Commission. 1882. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.7.

and Wilson's sewing-machine factory."⁸ This gives an impression of the prior nature of these borders. Coastal towns had granted leases prior to the commission and the commission's first two reports describe speculation and fraud over these. Pre-commission leases may have covered as much as one hundred thousand acres, and once the 1881 act appointing shellfish commissioners was passed, there was a rush to claim grounds in state waters too. By the time the commissioners formed their board, forty-five thousand acres had already been claimed.⁹ The commissioners questioned the legality of many earlier leases. These were often let "slip into the hands of a few favorites, contrary to the obvious spirit and intent of the law, and many of them at grossly inadequate prices."¹⁰ Their report lists the most questionable of these: Henry Rowe, Connecticut's largest planter, received leases of one thousand, three hundred fifty, eight hundred fifty, and four hundred fifty acres at fifty cents per acre.¹¹ Many leases had separate names but were then transferred to one person, or the signatures were all in one handwriting or did not match, and some did not even give names or locations. In some cases, the acres listed did not match the total designated, or much was said to be unsuitable and thus not paid for at all. One person leased almost eight thousand acres, but only paid for two thousand.¹²

In addition to these problems, documents and maps for pre-commission leases were often contradictory and poorly recorded, as in Rhode Island. The maps had been hand drawn on paper, with little money or instrumentation. Planters had hired their own surveyors. Sometimes a town hired one to make a map of a small area and then the town added to it. When a person applied, the town committee would go out and buoy the lease.

⁸ Ibid. p.39.

⁹ Ibid. p.47.

¹⁰ Ibid. p.48.

¹¹ Ibid. p.48.

¹² Ibid. p.xx.

They would then return and draw it on the map. The landmarks they used created problems for surveyors wanting to modernize the system. For one of the first leases in 1835, only one of six church steeples used as landmarks remained. Lease documents listed landmarks such as “west by range of bunch of bushes on knoll over gate on land by the late George Ferris.”¹³ An article from the *Fishing Gazette* described the transition to commission mapping:

Before the Commission came into power it was no uncommon thing for an oysterman to get a designation and deed from a town and carry it in his pocket for years, often losing them. Many long and expensive lawsuits have been caused by carelessness. There are sections of oyster ground in the State jurisdiction under cultivation and taxes paid regularly where the party occupying the ground could not show any title. The Commission has always recognized those claims.¹⁴

The commission drew up standardized lease forms and left record books in all twenty four coast towns. Town lease records were searched to make their initial map, but these were often “defective and incomplete.”¹⁵ Many claims overlapped. Some of these were uncultivated, and so the commissioners settled them easily. Some were cultivated though, and these were usually decided by the oystermen themselves, with the Commissioners doing little, but a few times it had to be given to the person with the oldest title. By 1884, the commission had resolved most disputed claims (see figure 6.1 for an example of a Connecticut lease map).

These early commissioner reports show the chaotic condition of leasing before the commissions. They also show several ways the commission sought to preserve the basic intent of the past system. There was only slight resistance to this process. The

¹³ Ibid. p.91.

¹⁴ *Fishing Gazette*, December 3, 1898.

¹⁵ Connecticut Shell Fisheries Commission. 1882. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.53.

Connecticut case also shows how the wealthier planters had more to lose from increasing state oversight. Making leasing more legible meant the state could reduce fraud.

6.2.2 The process and progress of property mapping

At its inception in 1881, the first action taken by the Connecticut Shellfish Commission was to hire a surveyor. Throughout the decade their reports contained an “engineer’s report,” which provided some of the most detailed records of the leasing and property mapping process. The problem they faced was the difficulty marking fixed points on water, as water has no landmarks of its own. Surveyors dealt with this by using triangulation to locate points on the water. This method consisted of first sighting three fixed points on the land, whose exact location was known. Then the surveyor measured the angle made by lines running from two of the locations to the boat. This process was then repeated with the other two points. These two angles changed as the vessel moved, so an additional point was needed to provide a third dimension, and this was provided by a sextant, which measured the declination of the sun. The sun thus provided the vertical point whose position is known. This process allowed the surveyors to map their location with a degree of accuracy and reliability.

Like many states, Connecticut’s commission received help from the U.S. Coast and Geodetic Survey (USCGS). Connecticut’s first engineer’s report describes how the engineer, James Bogart, went to Washington, D.C. to get USCGS maps. These measured sixty four feet long if placed end to end. The sheer length of these maps indicated their detail. Bogart’s first job was to trace all oyster lots onto the USCGS maps. These were reduced in scale and transferred to the master map. The USCGS schooner *Palinurus*

helped survey existing leases and helped determine triangulation points. They also helped the new commission establish confidence with the industry.

The commissioners considered Bogart's triangulation survey to be "the most important and far-reaching...of all the work that has been imposed upon them."¹⁶

Surveying could not be done until base lines were established and landmarks fixed.

Baseline surveys were more time consuming and expensive than the plotting individual lots because the landmark's latitude and longitude must be measured. In addition, signal markers would have to be raised in places where there were no suitable landmarks. The commissioners estimated this would cost \$.10 an acre and charged leasees accordingly.

Bogart started this survey at New Haven. He re-surveyed lots as he went, and these based on lessees' claims. Both lessees were present when their waters adjoined. In his first year, 1881, Bogart also set up thirty five signal stations. These were made from 4x6 wood, and were sixteen to twenty-three feet high with a black and white painted marker on top. He explained that he did not know how well the commission could maintain the position of the buoys marking the property lines. These swung around, leading to loss or gain of property when surveying. Deep water beds presented problems for accurately mapping too. The distance from shore signal stations magnified interference from the boat's sway, and the depth increased buoy movement.

Bogart received funds to purchase instruments in 1882. With USCGS help he set up and measured 118 more triangulations points that year. With this done, accurate maps could be made in all state waters now east from New York to the Connecticut River.

¹⁶ Connecticut Shell Fisheries Commission. 1883. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.4.

They placed 538 buoys, but “a large number of lots remain to be located and buoyed.”¹⁷

The commission was able to lease almost 90,000 acres by summer 1883. Bogart built nineteen more signal stations and the USCGS built sixteen more. Despite the large number of stations, they continued to use “lighthouse towers, beacons, church spires, factory chimneys, parts of buildings.”¹⁸ The schooner *Palinurus* continued to assist them. Rowe and other planters lent steamships to help place buoys.¹⁹ Owners accepted the commissioners’ findings in all cases save one, but there were still conflicts between adjoining owners. The owners generally took pains to treat each other fairly and avoid litigation.

By 1888, all state waters had been mapped, and all towns west of New Haven as well. The commission reported few complaints about town maps, although adjacent owners continued to have conflicts. By this time the engineering books added up to almost 10,000 double pages. There were forty-eight volumes of buoy books, sixteen volumes of buoy angles, five volumes of field records, six volumes of preliminary surveys, three volumes of signal records, twenty-four volumes of observational horizontal angles, four volumes of draft descriptions of all lots, eight volumes of Rhode Island boundary line survey notes, and one-hundred fifty maps. Again, the size of this undertaking shows that the commission was making property more orderly and rational without simplifying it.

¹⁷ Ibid. p.5.

¹⁸ Connecticut Shell Fisheries Commission. 1884. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.25.

¹⁹ By 1884, all of the 1881 deeds were drawn, all but twenty from 1882 were drawn, and about half of 1883’s were drawn. There were 118 triangulation points; 35 were markers. 347 buoys had been set, and 431 old buoys surveyed and reset as needed. They expect that every town would be given a map by 1885. The New Haven map was completed first, in 1885.

In Rhode Island, the 1881 re-survey helped increase tax revenue, and along with an increase in leasing, it led to a new high in taxes in 1885: \$11,920. The commission would also begin surveying deep water leases in 1883. After this time their tax and leasing information is regular and standardized, and commissioners stop complaining about property problems, so it seems they were able to achieve an efficient system by the mid-1880s, which was substantially sooner than other states. Their system also had a much higher tax rate and generated large revenues for the state, peaking at \$135,000 in 1913.²⁰

The surveys rationalized the older property system, but this remained a fitful process throughout the Progressive Era. The Connecticut legislature cut all mapping funds after Bogart completed his survey, apparently due to a political struggle over appointments to the commission. Although the commission lobbied for restored funding, the legislature did not again fund surveys on an extensive scale. The commission reported that boundary disputes constantly arose during this period due to “obscure designations,” “inaccurate location on the water,” and the decay of shore landmarks and signal station.²¹ An 1896 *Fishing Gazette* articles described Connecticut mapping this way too. It explained that funds allocated for buoying were inadequate, going on to say:

The cry for the resetting of these buoys is constant, both from the oystermen who work the natural beds and from the owners of grounds adjacent thereto. The fact that the State does this work at all leads all parties to rely upon it, and the planters are less liable to keep their own buoys upon the natural bed boundaries, claiming, with considerable truth, that only the State buoys will be respected. Owing to the impossibility of keeping all the beds buoyed all the time, the Commission has been compelled to disregard many of the calls for the resetting of buoys and has only done what, in its judgment, the conditions most imperatively demanded.²²

²⁰ Connecticut Shell Fisheries Commission. 1914. *Annual Report of the Commissioners of Shell Fisheries*.

²¹ Connecticut Shell Fisheries Commission. 1889. *Report of the Commissioners of Shell-Fisheries of Connecticut*.

²² *Fishing Gazette*, June 20, 1896.

Connecticut's situation shows the tenuousness of these early rationalization and knowledge production efforts.

6.2.3 Valuing oyster property

Rhode Island had by far the highest planting property tax rate of any state, but planter tax evasion was a bigger problem in Connecticut. This was because they tried to tax property based on its value, instead of having a flat tax, and this meant they had to make underwater property's value visible too. Connecticut commissioners collected for the first time in 1884, and although there was little outright evasion, commissioners had trouble establishing fair tax rates. The law taxed oyster leases according to their value. All owners were required to file with the commissioners, under oath, the acres they owned and their value per acre. The commissioners complained that "With many honorable exceptions, the valuations of cultivated grounds have been set at ridiculously small figures," meaning that planters were lying about how much their oysters were worth.²³ The commissioners felt the valuation should be increased ten fold. Adjacent and identical lots varied hugely. The commissioners "equalized" this list, which means they taxed everyone the same, based on an average, which they said was still too low.

In 1885, the commissioners began supplementing planters' reports by asking field surveyors to determine oyster property values. However, they stated that "[i]t is difficult for the uninitiated to appreciate the obstacles that must be overcome before reaching a just conclusion about the value of any sub-marine lot."²⁴ They had to take into account

²³ Ibid. p.9.

²⁴ Connecticut Shell Fisheries Commission. 1885. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.10.

the bottom type, depth, currents, food, predators, etc. However, the commissioners claimed to know a great deal about all of these. Trials between oystermen over boundaries were a key source of information too. Their experience led them to believe that “[t]he Commissioners have more complete and accurate information...than probably any other three men.”²⁵ They determined taxes after asking for lessees’ valuation, and taking into account all their information and past years’ valuation. Lessees were notified, and given a chance to appeal before the commission. Most approved and paid promptly. Some lessees complained “with considerable acrimony” in the press, but the commissioners said the loudest complaints came from those who held more than they could cultivate or those who held acres to speculate.²⁶ The commissioners’ efforts applied to state water only; towns taxed their oyster grounds, often at much higher rates. State taxes ranged as high as \$50/acre, but averaged less than \$0.10/acre. The commissioners reported hearing of sales for \$100-300/acre.²⁷ The commissioners felt the best grounds were more profitable than the state’s best farmland. In 1887 they still felt leases were undervalued. An 1891 law took away their power to value plots, although one of them sat on an advisory board to the clerk who now did this. They were back given this responsibility in 1895.

Accurately measuring property value was difficult for the commissioners. Their efforts to do showed that these new agencies, in contrast to Scott’s cases, wanted to make capitalists’ property and productivity visible too. Capitalists resisted this process when it suited them. It is important to note too that planting property taxes were a regular source

²⁵ Ibid. p.10.

²⁶ Ibid. p.11.

²⁷ Ibid. p.12.

of state revenue in Rhode Island, but they only contributed to commission funding in Connecticut and other states.

6.3 Small scale commissions: New York and New Jersey

New York and New Jersey's mapping efforts were different than in other states. Their numerous local small scale commissions mapped leases. Unfortunately, due to the small size of these commissions, few of their reports survive. None remain from New York and only ten remain from two of the seven district commissions in New Jersey. Evidence that does exist shows these agencies tried to rationalize pre-existing property.

Following Blackford's advice, New York established a state Shellfish Commission in the late 1890s to oversee a new leasing system designed to legalize the town grants already in place. By 1896, they had leased over 15,000 acres and had mapped leases in Jamaica and South Bays.²⁸ New York also founded town shellfish commissions to continue small scale management and mapping. The state still has a local shellfish commission system.

In New Jersey, district commissions mapped leases. The 1901 New Jersey state report recommended giving Ocean and Atlantic County planters' rights to the areas they had staked already.²⁹ The new district commissions in these counties were expected to first set aside clam grounds and natural beds, and then establish leases. The Ocean County District Commission began leasing in 1902. Leases legalized planters' pre-existing claims, which were usually already marked with stakes. According to the *New*

²⁸ Ibid.

²⁹ New Jersey Oyster Commission. 1901. *Annual Report of the New Jersey State Oyster Commission*.

Jersey Courier, a syndicate stood ready to buy all the leasing grounds in the bay, but the district commissioners preferred to lease it to prior claimants.³⁰

The Ocean County District Commission's 1903 report mentioned extensive surveying in 1902-03. The author claimed the commission was trying to protect planters from "the depredations of the so-called 'free bottom' class," which probably refers to illegal harvesters.³¹ The 1903 report also stated that they lacked adequate funds for mapping. Many people told them their task could not be done, and they encountered great difficulties. Their main problem was that most oyster growers would not show up to tell them where their oysters were. The report said "[m]any applicants disregard the Commission's request altogether...only a few comply."³² The report did not give a reason why this was the case. Lots were small and irregular, which made them harder to locate. Lessees were allowed to estimate the size and location of their own holdings. To add to their difficulties, faulty equipment forced them to abandon all surveying for the year.

Other sections of the state were surveyed by district commissions too, but their records were lost. The *Fishing Gazette* mentioned that in the summer of 1899 New Jersey's Oyster Commission had established several surveying stations along Maurice River Cove and Delaware Bay. The commission saw markers as essential for bounding lots as well, but many were placed below high tide. However, newspaper articles discussed numerous problems with unmapped beds and planting grounds, so it is unclear how widespread this was. It is likely that it was referring to the Southwest Line or

³⁰ *New Jersey Courier*, October 7, 1902.

³¹ Ocean County Oyster Commission. 1903. *Annual Report of the State Oyster Commission for the District of Ocean County, New Jersey*. p.36.

³² *Ibid.* p.36.

Maurice River Cove only. The next year they discussed displaying a map of “the cove” that “proved so extremely interesting to the oystermen.”³³ According to the report, the oystermen approved of the map and crowded to examine it. It increased the size of planter holdings by about one third.

Atlantic County District Commission reports began in 1905. The creation of the commission followed a 1905 law stipulating that district commissions had to create lines separating clam grounds from oyster leasing areas. The commission’s first task was setting aside clam grounds and natural beds, and then renting planting grounds, not all of which were surveyed immediately. There is a gap in district commission reports from 1908-1912. In 1912, the Ocean County commission said that although the law required surveying leased beds there was no money for this. They said former commissioners never completed this, creating confusion. The new commissioners did not survey the last two years of leased lots. They recommend making all leases on the water and changing lines between oyster/clam lots as conditions change.³⁴

In summary, the New Jersey district commissions’ main activities were leasing and mapping. Commissioners also separated clams, natural oyster beds, and leasing areas, which followed local customs (see chapter seven). In Atlantic County there is some evidence of corruption, and in Ocean County sources mentioned an attempt to use the commission leases to create a monopoly. These cases show that there were contests for control of these commissions. The New Jersey case also illustrates planters’ ambivalence towards mapping efforts, and the difficulties commissioners had carrying out their tasks.

³³ New Jersey Oyster Commission. 1901. *Annual Report of the New Jersey State Oyster Commission*. p.3.

³⁴ Ocean County Oyster Commission. 1912. *Annual Report of the State Oyster Commission for the District of Ocean County, New Jersey*.

6.4 Mapping opposition to leasing: Maryland

Maryland was unusual in that popular opposition limited leasing to much greater extent than any other state. Its history shows again how traditional measures persisted, in this case against commissioners' recommendations to expand planting.

Maryland passed one of the country's first planting laws in 1830. The so-called "one acre law" gave riparian owners the right to plant oyster on up to one acre adjacent to their property. This changed in 1865, when the state overhauled its oyster laws. The new "five acre law" allowed riparian owners to plant up to five acres. It set up a licensing system for this, and also for tonging, scraping, and newly-legalized dredging. Most of the five acre leases were used for bedding rather than planting.³⁵

The biggest push to expand leasing came as harvests dropped in the early 1900s. Baltimore lawyer B. Howard Haman championed planting/leasing legislation in the state legislature for fifteen years. He finally succeeded in passing the Haman Oyster Culture Law in 1906. The law was subject to a large public debate; at least thirty-five articles appeared on the issue on the *Baltimore Sun* between May 12, 1905 and April 11, 1906.³⁶ The law's purpose was to encourage and expand planting. The main way it did this was to allow any Maryland citizen, rather than just riparian owners, to plant up to five acres, and it allowed them to do so anywhere in the state without natural beds. Haman had to compromise to get support for the bill, and so it included provisions written by its opponents. One was to limit planters to using tongs. Another was to limit the period planters could work their leases to the same time as the natural bed closed season.

³⁵ Grave, Caswell. 1912. The history of oyster production in Maryland. In *Fourth Report of the Oyster Commission of the State of Maryland*. p.291.

³⁶ Keiner, Christine. 2001. *Scientists, oystermen, and Maryland oyster conservation politics, 1880-1969: a study of two cultures*. Ph.D. diss., Johns Hopkins University. p.68.

Ostensibly measures to make it easier to stop illegal dredging, these two provisions decreased the efficiency of planting. The law also contained an anti-monopoly measure that banned corporations or joint-stock companies from leasing.

Caswell Grave, a Maryland oyster commissioner, said that the Haman Act failed because its opponents made sure planters would not have the rights they needed to farm oyster profitably, and they were able to do this because they understood what planters needed better than Haman.³⁷ Grave also blamed planters' lack of organization and knowledge. He said Maryland planters had failed to properly support the Act because they did not "recognize the natural division of labor which exists in oyster culture, and also [because they have] failed to take into account the biological and physical conditions upon which these divisions depend."³⁸ As examples of this, Grave discussed how planters had tried shelling under the five acre law, but these riparian leases were usually upstream from natural beds so there was little set. Shelling's failure convinced oystermen planting could not work, and since this view became widespread tongers thought planters were really trying to get the natural beds. There were also numerous cases he came across where the planters put too many oysters on too small an area, and these perished or stagnated for lack of food, which planters took to mean that cultivation on barren bottoms was impossible. Grave, who was also a scientist, pointed out that cultivation on land was based on knowledge of what can be planted where, "but in the case of water territory, there seems to be a general feeling that its resources are unlimited."³⁹ He concluded that underwater facts were harder to get and less well known than terrestrial farming.

³⁷ Maryland Shell Fish Commission. 1912. *Fourth Report of the Shell Fish Commission of the State of Maryland*. p.289.

³⁸ Ibid. p.291.

³⁹ Ibid. p.291-3.

Grave and other commissioners recommended amendments in 1908, but these were rejected because 1906's heavy set increased production. When harvests dropped in 1910, the legislature passed a Reshelling Act against the Commission's advice, but the tax for this was declared unconstitutional. By 1912 the legislature agreed that something had to be done and passed the Price-Campbell Act modifying the 1906 law. This allowed for much larger leases: 100 acres in county waters and 500 acres in state water farther offshore. It also allowed planters to use dredges and work year round. This was a victory for planters and their advocates; it reversed the Haman Act measures that had hobbled planting.

After the Haman Act, the commission mailed notices to over 4,000 lessees asking them to renew and register their lots. Only 853 out of 4009 responded, despite prominent notices in the local papers too, and only 472 actually took out leases. Many were waiting until the survey was done to lease other (or more) lands instead.⁴⁰ The prior surveys were often inaccurate and their shore points cannot always be located. The commission had to reassess all old lots (the 472) and these sometimes overlapped each other or natural beds. The resurveys were done in the presence of the owner. The commissioners felt the state needs a qualified hydrographic engineer to use maps; they felt county surveyors could not accomplish this type of work. They also felt that these lease numbers were not a good indication of interest in cultivation in Maryland.⁴¹

Applications for leases rapidly increased following the 1912 law. In 1912, there were only 141 leases covering 1,058.5 acres. By 1913, there were applications for an

⁴⁰ Maryland Shell Fish Commission. 1913. *Sixth Report of the Shell Fish Commission of Maryland*. p.255-6.

⁴¹ Maryland Shell Fish Commission. 1912. *Fourth Report of the Shell Fish Commission of the State of Maryland*. p.253-6.

additional 30,000 acres with more applications flooding in.⁴² The commission had to decide on rental scale for these. H. F. Moore, a USFC scientist who often consulted with Maryland's commission, recommended surveying the leases' natural conditions to establish their productivity and then charge planters accordingly. In the meantime, the commission instituted a new flat rate, which was lower than in the past. The commission issued 152 new leases covering 5,666 acres in 1913. People could legally patrol their own property and arrest trespassers.⁴³

The new law drew immediate protest. One major complaint was that leases were taking up natural beds. From 1906-1912, surveyors had mapped Maryland's natural beds, and these were now off limits to planters. The first major problem with this survey arose in the Patuxent River. In summer 1912 the commission's engineer was shown a natural bed in an area open for leasing. It was fifteen acres, and the natural bed survey had missed it. The commission was powerless to not lease the area and they advised the local oystermen to lease all the part that was left at that point (some of it had already been leased).⁴⁴ The commission received numerous complaints like this. They identified several causes. First, many oystermen claimed any place with a few shells or that once had oysters was still a natural bed, contrary to the law. Second, in some places new oysters were growing that were absent during the main survey. Third, most natural beds were not marked with buoys. Fourth, county authorities did not always see how important the survey was and so they did not always appoint the most knowledgeable people to direct the surveyors, which led them to miss some beds. Fifth, many oystermen "are

⁴² Maryland Shell Fish Commission. 1913. *Sixth Report of the Shell Fish Commission of Maryland*.

⁴³ Ibid. p.26-7.

⁴⁴ Ibid. p.7-8.

violently opposed to oyster culture in any form.”⁴⁵ By 1914 there were protests for 42,000 acres.⁴⁶ Due to the number of protests, the commissioners decided to delay leasing protested areas. They recommended the legislature give them more discretion in granting leases. They also recommended charging protestors for the re-survey if they find nothing (otherwise the state would pay, which would help limit the “indefinite” protests that “flooded” them).⁴⁷

Opponents of leasing were also active in the legislature, and the contested acres gave them a new weapon. In 1914 the legislature passed the Shepard Act. This act, like the Haman Act it modified, provoke a large public controversy.⁴⁸ It weakened the Haman and Price-Campbell Acts by changing the designation of public beds so that any place oystermen had found oysters in the last five years would be designated as off-limits to planting. Second, all that was needed to establish this was the testimony of any three oystermen in a Circuit Court. The act also gave the Shellfish Commissioners the ability to change designations to clarify disputes, as they had recommended, but the practical impact was to stop leasing. Oystermen immediately filed into the courts and designated 54,000 acres of new natural beds. Planting leases stood at 5,666 acres in 1914, with 9,529 more “awaiting signature.” In 1930, there were about 9,000 acres leased, and this number remained roughly same through the 1980s.⁴⁹

Rural people forced the legislature to uphold and formalize traditional management practices in Maryland, but this process differed from other states in the extent of opposition to leasing. This put oystermen at odds with their “high modernist”

⁴⁵ Ibid. p.9.

⁴⁶ Ibid. p.12.

⁴⁷ Ibid. p.13. For some reason, about three fourths of the protested acres were in Dorchester County.

⁴⁸ Keiner, 2001, p.72.

⁴⁹ Kennedy and Breisch, 1983.

commissioners. In 1916, Maryland's reorganized Conservation Commission was still trying hard to sell oystermen on the virtues of planting. They felt "[t]he oysterman has been his own worst enemy," and their report reprinted a letter they circulated explaining to oystermen why they should support planting.⁵⁰ The commission also planted 100,000 bushels on 600 acres in 1914 and protected these for two years, then opened them to all oystermen to show the benefits of planting. Despite these earnest efforts, Maryland's modern oyster management pattern was set by 1914.

6.5 Mapping leases to resolve disputes: Virginia

Virginia's planting and leasing history highlights the way lease mapping was used to resolve disputes between planters and tongers. This was important everywhere, but it was the most commented on aspect of lease mapping in Virginia, and the state provides a good example of how this related to rationalizing traditional practices.

After the Civil War, the state began consolidating laws and increasing control, and northern investment declined.⁵¹ Several sources describe planting around 1880. McDonald said planting grounds were held by an irregular system of licenses.⁵² Armstrong said that many persons hesitated to plant because it was easy to claim they were on a natural bed, and then anyone could take their oysters.⁵³ Ingersoll described how there was little dredging on planted beds, since it was hard to stay on one's own bed.

⁵⁰ Maryland Conservation Commission. 1916. *First Annual Report of the Conservation Commission of Maryland*. p.6.

⁵¹ 1870s laws gave exclusive planting rights to landowners who held both banks of streams, and said that shore owners could ask for planting rights in areas adjoining their property. Planters had to stake their claims and have an inspector verify it or others could take up the area. In cases where multiple persons applied for planting grants, the area was auctioned. Northern planting was diminishing, and the law restricted non-residents to bedding during the open season. The General Assembly could revoke any planting lease.

⁵² McDonald, 1880.

⁵³ Armstrong, W. N. 1879. *Notes on the oyster industry of Virginia*. Hampton.

Planters disliked dredging by their neighbors and hence did not do it themselves. He described beds as only having around one stake per fifty yards.⁵⁴ Despite the uncertainty planters faced, it was one of the largest planting fisheries in the U.S.⁵⁵

As seen in the chapter four, oysters were a major topic of legislative debate in the early 1890s, which focused on how to tax oysters, protect oyster supply, and resolve planter-tonger conflict. These culminated in an 1890 bill requiring all planters to have their ground surveyed prior to leasing, and it also required a general survey of all natural beds. The bill had the support of tidewater senators and representatives and was seen as a workable compromise between planters and tongers. However, Governor McKinney vetoed the bill. A pamphlet entitled “A Defense of the Tidewater Oyster Industry” described tidewater grievances, saying the region felt it was taxed heavily but was neglected by the legislature. It went on to say the press was teeming with oyster articles this year. It described an “oyster-industry mass meeting” in Mathews County on January 17, 1891, where there were “ringing resolutions adopted demanding reform in the oyster law.”⁵⁶ Oystermen had hoped the last bill would pass and this would settle their disputes. The mass meeting recommended protecting and rigidly defining natural beds, surveying leases, fifteen year leases, banning dredges, and a tax exemption for shelling. Despite the uniformity and compromise seen above, Governor McKinney’s major address on oysters stated that tidewater oystermen could not agree on what legislation was best, splitting among planters, tongers, and dredgers.⁵⁷ He favored planting, saying that strictly

⁵⁴ Ingersoll, 1882.

⁵⁵ Lynnhaven, Hampton and Chincoteague were major planting areas, as were the Rappahannock and Potomac Rivers. Ingersoll estimated the latter two areas had roughly 1,000 planters, about 5,000 employed, and around 400,000 bushels planted annually.

⁵⁶ Stubbs, James N. 1891. *A defense of the tidewater oyster industry*. Richmond: Everett and Waddey Co.

⁵⁷ McKinney also mentioned that a special act in 1888 gave 3,000 acres to one person for twenty years and only \$.20/acre (the act was repealed the next year).

enforcing the closed season would prevent gathering seed oysters in summer and this shorter season would force tongers to plant, as they would have nothing else to do in summer.⁵⁸ In an address at a major convention of planting advocates in Richmond on January 24, 1894, he stated that “local prejudice [was] wearing out” and this would open room for “efficient legislation.”⁵⁹

Despite the Governor’s pro-planting, high modernist stance, the 1892 reform law was a substantially the same as the 1890 bill. It balanced the interest of planters and tongers, and it tried to end conflict between them by ordering surveys of natural beds and planting leases. The Board of Fisheries oversaw leasing under the new law, and they conducted surveys to established signal points and resolve disputes. Its oyster inspectors received lease applications and made sure planters were using the correct grounds. Inspectors’ jurisdiction was divided by county, but county lines were poorly marked on the bay or not marked at all, creating confusion and overlap. One report described the results, saying, “the confusion caused by this is something that is hard to explain to one that has not seen the like.”⁶⁰

After this there is little information until 1906. W. McDonald Lee did much to modernize the Board from 1906-1912, and evidence from this time period show the difficulty involved in rationalizing leases. In 1906, Lee “broke up the pernicious ‘permit’ system” in the James River.⁶¹ Under this system, people would lease ground next to natural beds and then sell written notes to tongers who would work the natural beds during the closed season, slipping back onto legal ground when inspectors came. The

⁵⁸ McKinney, 1892.

⁵⁹ McKinney in Ellyson, 1894.

⁶⁰ Virginia Board of Fisheries. 1901. *Report of the Board of Fisheries*. p.22.

⁶¹ Virginia Board of Fisheries. 1906. *Report of the Board of Fisheries*. p.7.

notes gave permission for them to work the leased areas. Judges wanted convictions but juries continually sided with tongers. The new Board was able to get convictions and change public sentiment. Even as they began to eradicate this in the James River, the same system started in the Rappahamock and Potomac Rivers. It remained hard to get convictions there, costing the Board much time and effort. Many planters were also harvesting from natural beds adjacent to their plots. Lee felt the natural bed lines need to be re-surveyed everywhere, “*and permanent markers should be placed when this is done*” (italics in the original).⁶² Part of the difficulty stemmed from the leases not having any kind of uniformity or regular lines, which complicated accurate property leasing.

A 1908 trade publication article claimed 8,000 men worked on planting grounds, most of them hired hands. It said planters and tongers were still in conflict over space. It also said planters wanted a secure, stable seed supply and feared tongers would deplete beds because they saw oysters “much as the original settlers did” when game formerly abounded.⁶³ Two 1909 articles discussed a Chincoteague inspector. The first letter said he was also a planter, which was illegal, and had assigned land designated as natural beds, including that which he assigned himself.⁶⁴ The inspector then responded, saying his accuser harvested illegally.⁶⁵ Another article claimed some planters paid for illegal seed to empty natural beds so that they might one day be opened for planting. It also said about one fourth of potential planting acres were leased, but seed supply was not enough seed for all planters now.⁶⁶

⁶² Virginia Board of Fisheries. 1907. *Report of the Board of Fisheries*. p.18.

⁶³ *The Oysterman and Fisherman*, November 1908.

⁶⁴ *The Oysterman and Fisherman*, January 1909.

⁶⁵ *The Oysterman and Fisherman*, May 1909.

⁶⁶ Ibid.

Tongers began to increase again after 1913, probably due to increases in natural beds. The Board stated that there were at least 6,760 tongers, each of whom employed a culler. Planters numbered about the same. A “better feeling” had developed between these groups, both now having a better sense of their rights due to litigation. Planting was not growing, and it was kept down in part by cheaper price of tonged/dredged oysters. Planters rented 57,336 acres in 1913,⁶⁷ a much higher figure than in neighboring Maryland. The Virginia case shows a different reason why commissions rationalized tradition. In Virginia this was a slow process of establishing accurate lease maps to settle disputes between tongers and planters.

6.6 Discussion: state mapping without simplification

These surveys show how hard it was to map planter property. The state’s new knowledge production strategies all aimed at making things visible, and aquatic property presented a special challenge. This accounts for the magnitude of the mapping projects. The detail of the resulting maps shows that surveyors did not simplify planters’ property rights in the process of making them more legible to a central authority. This visibility did make capitalist investment and frontier expansion easier, and it did expand state capacity. The latter aspect aroused resistance to visibility to when planters faced new taxes. This shows that capitalists sometimes resisted state visibility projects too. In fact, the wealthier they were, the more they benefited from obscuring the state’s vision.

Although property mapping aided state and capitalist frontier expansion, it also bureaucratized traditional norms and practices. In Rhode Island, the legislature ordered surveyors to protect tongers’ property in the “free fishery” and made generous allotments

⁶⁷ Virginia Board of Fisheries. 1913. *Report of the Board of Fisheries*.

for them. Thus mapping both helped expand planter's property, by making investment less risky, and limited it, by keeping it off public beds. In Connecticut, property mapping preserved town management. Planters' rights were an important and long held norm in this fishery, and property maps rationalized these too.

Mapping aquatic property was inherently difficult. Leases needed to be drawn in an abstract form in the same way terrestrial property was and it needed to have clear boundaries. Boundaries depended on demarcation and the ability to relocate specific spots in reference to other fixed points. On land surveyors could mark trees or put up fences, but the surface of the bays were harder to mark. Stakes worked in shallow water, but storms knocked these over. Buoys were useful to mark deeper water, but these were impermanent too. Water also lacked landmarks, so surveyors had to use ones constructed on land. The lack of permanent markings on the water's surface made it a difficult medium for property mapping, which meant state cadastral mapping would be a slow, laborious process. These inherent difficulties made it harder for would be high modernist commissioners to impose a radically new property system.

The history of U.S. oyster planting mapping is different than the model Scott develops. In his case studies, local knowledge is overridden or ignored by state planners, whereas in this case planter's knowledge of property was preserved. Similarly, Scott's local property systems are displaced, not maintained. He characterizes the new, high modernist maps as simplifications of older systems, which they were, but simplification is not the right word for the process in this chapter. The new property maps made the system more static and abstract, but they did not decrease the number of plots nor the level of detail contained in knowledge about them. Connecticut's sixty four foot property

map was a complex rendering of property. But this map was different from the knowledge that preceded it. It was more rational, orderly, and rigid, and most importantly, it was visible to a central authority and fit into a legal framework. These maps rationalized knowledge without simplifying it.

There are several reasons for these differences. One is the difficulty of mapping aquatic property mentioned above. Water “resisted” high modernist schemes. Another key reason was the simplicity of the preexisting property. Scott’s cases involve complex overlapping usufruct rights. Planters’ rights were simpler; they were harvesting one crop, and property lines did not, in principle, overlap. The main source of complexity was the ambiguity created by the property being underwater. The “lines” were hard to mark and so planters’ notion of where they were varied. This was a type of complexity that the new maps erased, but this did not undermine the stability of the system, in fact, it may have helped it. Another difference was that in all states except Maryland mapping sought to conform to tradition, and in Maryland oystermen defeated property mapping proposals that strayed too far from tradition. Part of this was due to oystermen’s resistance, and part due to the attitude and power of the commissioners. Many were not high modernist in any identifiable way, and in any case they lacked the power to carry out radical property reordering.

Chapter seven: mapping natural beds

7.1 Introduction: rationalizing tradition

To modernize oyster management, the new commissions needed to map natural beds. Surveyors not only made maps. They also published reports of their work, especially in the USFC's Reports and Bulletins. Many of these included detailed descriptions of their methods. With important exceptions, later surveys only discussed out of the ordinary methods they were forced to use, simply stating that their methods were the same as an earlier practitioner, often H. F. Moore. The USFC also provided boats, usually the steamer *Fish Hawk*, for all of the surveys except those done by the states. The U.S. Coast and Geodetic Survey also provided a few of the most important surveyors in the Chesapeake.

The basic problem confronting surveyors was the need to find a way to accurately map these areas on the one hand, and to find a way to appease oystermen who would potentially protest the surveys on the other. Each state tended to work out a different solution to the dilemma. The following chapter discusses how each state mapped its natural beds, but it begins with a discussion of the problem of defining natural beds.

Most of the literature on cultural cartography, and the social construction of nature, looks at knowledge production in a linear fashion. Experts produce knowledge that pictures nature. In doing so they empower themselves. They do this because they claim expertise in picturing nature, and they use this to call for certain courses of action. If states or people follow this course of action, the experts have gained power. People who follow such advice do so because they are persuaded to see things differently by the new knowledge production, often altering the way they see themselves in the process. At

the same time, expert knowledge production makes nature (and people) more visible to a central observer (the state, scientific communities, a corporate head, etc.), and this visibility facilitates intervention. Expert knowledge production often aids capitalism too because it facilitates investment and development, and because capitalism requires abstract property rights. Overall, the literature portrays this process in a negative light because it empowers experts (and capitalists) at the expense of more democratic forms of power. It concentrates power in the hands of knowledge producers.

In the oyster case however, things happened differently. Knowledge production bureaucratized tradition instead of eclipsing it. “Tradition” was a complex compromise born out of political conflict. The new knowledge production made the practices that evolved as the outcomes of these conflicts visible to central authorities. However, there was a tension between traditional ethics and the new knowledge production practices. This was Weber’s tension between substantive and formal rationality. This tension was increased because many of the knowledge producers favored the formally rational goal of increased productivity.

Mapping natural beds was done to open and secure space for planters, but the commissions had to reserve places for tingers to do this. In this way they were mapping traditional compromises over space, resource access, and property rights. Maps made these compromises and practices visible to the state in a new way, but it was harder to render ethics into a rational form. This came down to how one defined a “natural bed.” How one did so determined exactly where the line on the map should be drawn, and the hallmark of this new knowledge was that there had to be one line. Cartographers went to great lengths to try to quantify the definition and location of beds in order to make truly

accurate maps, but this proved impossible as the ethical compromise ??? was not something that could be reduced this way. Because of this, maps were never objective, they were social constructions shaped by political conflict and compromise. I argue that they succeeded precisely because cartographers departed from objective, quantifiable accuracy and because they instead openly embraced the political nature of their projects. Not all cartographers operated this way, but the ones who strove for accuracy above all else tended to fail; their maps were more often rejected.

This case shows a more complex pattern of state resource mapping, and it shows that tradition could guide this process. Section 7.2 looks at how commissions and courts defined natural beds. There were two ways states then employed this definition. The first was to make broad straight lines, and section 7.3, covering Rhode Island to New Jersey, describes this common mapping practice. The other option was to make what I call precision maps. Section 7.4 examines this type of mapping in Virginia, which was much more high modernist. This section also explores the rationale for these high modernist projects. Some surveyors also used maps to influence behavior, and section 7.5 discusses this process in Maryland and the southern states.

7.2 Defining natural beds

The first problem confronting surveyors mapping tongers' property was the question, what is a natural bed? The term "natural bed" was another name for an oyster reef, and the word "natural" had come to mean, through nineteenth century court cases and legislation, that they excluded planting grounds. Surveyors needed to map these to reserve them for tongers and prevent planters from intruding on them, and, as seen in the

last chapter, to open the rest of the bays to planters by removing the ambiguity and insecurity of title. The definition of “naturalness” would become an important legal issue because it was the legal term used to define spatial property boundaries.

A Maryland case in Dorchester County furnished what became the guiding definition of a natural bed. Judge Charles F. Goldsborough in July 1881 (William T. Windsor and George R. Todd versus Job T. Moore) decided that a natural bed was any place with enough oysters for someone to make living tonging it. Surveyors would refer to this as the “Goldsborough Definition.” This definition was drawn from previous court cases. Conflicts taken to the courts had crystallized debate on the meaning of this term, and the resulting definition embodied a traditional compromise born from these conflicts. Goldsborough was following and distilling this precedent, and not inventing a definition through common sense. Goldsborough was the judge who brought Timmons before a grand jury and charged him with taking bribes as head of the Maryland oyster navy. Newspaper articles on the Timmons case show he was sympathetic to tongers. His definition was a reasonable attempt to put their traditional ideas into a legal framework.

Despite Goldsborough’s intentions, there were several difficulties with putting this tradition into a legal administrative framework. The first problem was what to do with places with a few scattered oysters. If these were so few that no one harvested them, then should these be considered natural beds? This definition would greatly expand tonger property. One solution was to define natural beds as places where oysters were found in concentrations that afforded tongers a livelihood. Several surveys tried to quantify the density of oysters required to merit inclusion in this definition. As seen below, the Moore and Yates Surveys in particular went to great lengths to put this

definition into its survey boundaries. This definition had to change with economic fluctuation, as tongers needed denser beds when prices were low to earn the same income, which complicated it.

Another problem mapping natural beds was that their boundaries would often change. Although the individual oysters attached to one spot, over time beds shifted, especially after storms. To accommodate these shifts, surveyors sometimes recommended establishing public property rights a certain distance around the current beds, creating a buffer to allow for natural movement. Others instead recommended re-surveying beds periodically and adjusting boundaries accordingly.

A tougher problem was the existence of beds that were well known but had disappeared. Should these locations have the same public property rights as regular oyster beds? Since no one was using them this would seem to be a moot point, no one would care. However, tongers frequently objected to surveys that missed these locations, arguing the oysters might return, or that they could be brought back with shelling and seeding. Others thought granting defunct area to planters would open the door to further encroachment. Responses to the tongers' challenge varied. Some surveys made a conscious decision to omit these places, whereas others set a cut off date (an area would only be mapped as a natural bed if it had oysters in the last ten years, for instance), and still others tried to map these non-existent beds. Obviously mapping oyster beds that were not there presented its own difficulties, and surveys that did this made property recommendations for these areas based on oral testimony and public hearings. Attitudes towards how to handle this question sometimes varied within the same commission.

Dredging created a final problem with the beds' boundaries. Over time, dredging tended to spread out beds. It broke up oysters that were clustered together, and if the smaller ones or cultch were thrown back, they drifted down in a more dispersed pattern. The Chesapeake, due to its extensive dredging industry, was an extreme case, and this process was already well under way by the first survey (Winslow's of 1878-9). The oyster beds had been so disrupted and dispersed by the time of Moore's James River survey (1909) and Yates' Maryland survey (1906-12) that vast areas of the bay had "natural beds" where none had existed before. In all other states, such extensions were always classified as natural beds. This was the surveyors' only possible solution, as any attempt to determine where the beds used to end would be futile, and this solution was politically feasible because these expansions were not big enough to seriously limit cultivation. But in the Chesapeake they were more than big enough; by the 1900s the beds had expanded to cover much of the sounds. One solution was to classify the entire area where oysters were now found as natural beds. Such a solution would greatly limit cultivation. The opposite was to admit defeat and say it was too late to map the natural beds and therefore the entire area would be opened to cultivation, which was politically impossible in Maryland. Any middle ground between these would have to be based on a political compromise, as there was nothing in the environment, such as water depth, that lent itself to a neat division.

The term "natural bed" referred to a natural and social object at once. Oysters themselves were natural, but the beds denoted places with enough oysters to bother harvesting, and the cut off line varied with individual preference and market condition. Even the natural part of the definition was variable, as oysters shifted positions. The

problem of exhausted beds also showed that tonger property was a social construction; tongers could feel they had property rights to places with no oysters at all.

In contrast, planter property was easier to map because it had relied less on nature. Planting lease boundary lines used natural reference points, but these could be fixed in one place. Tonger property depended on oysters, which moved around. Planters' fixed points were above water, and tongers' oysters were below, making one much more visible than the other. Because planters' property relied less on variable, obscure natural features, it fit more easily into a legal administrative management framework.

The social nature of this definition created problems for surveyors, whose scientific, quantitative tools had no way to map a variable, contentious social construct. It was unrealistic to expect cartographic science to objectively settle a complex political question. And yet, putting oyster management on a modern administrative legal basis meant commissions had to map tonger property somehow. Mapping promised stable and secure rights, but asking cartographers to objectively settle disputes through science was asking too much. As will be seen below, surveyors adopted one of two solutions: they either created simple straight lines that divided bays, or used rigorous methods to precision-map oyster beds.

7.3 Straight line mapping

7.3.1 Connecticut and Rhode Island

Rhode Island's commission reports did not mention mapping natural beds. Planting was restricted to areas more than four feet deep, and this obviated the need for

detailed maps. Rhode Island's solution to the difficult question on mapping natural beds was a simple division of Narragansett Bay by depth.

In Connecticut, cartographers mapped natural beds at the same time that they were completing cadastral surveys of planters' leases, which began in 1881. Most natural beds were in state waters, so mapping them fell under the state commission's purview. Their 1882 report mentioned mapping three beds. The commissioners "experienced no little difficulty" in this because "[g]reat difference of opinion exists as to what constitutes a natural bed; while testimony as to their size and shape is conflicting and untrustworthy."¹ The commission held public meetings to hear opinions on the beds' location and extent. People appeared in person or were represented by counsel, and there were extensive hearings. Two classes participated, tingers and planters, the former wanting them to be as big as possible, and the latter wanting to restrict their size. Commissioners stated that the grounds adjacent to natural beds were very valuable, which made natural bed boundaries a contentious issue, but they did not explain why planters valued these areas.

The commission discussed the difficulty in adjudicating these debates, given the complexity of defining natural beds:

what, according to the intent of the law, is a natural bed? Various definitions have been attempted. In one sense, all oyster beds, whether a result of cultivation or of accident, are natural beds. But it is not in this sense that the term is commonly used and understood. That is true in the general sense, but it does not describe the natural bed which the law designs to recognize and protect. Small isolated patches of natural growth oysters cannot be deemed natural beds within the meaning of the law; but when such patches are found scattered over an extent of ground in sufficient abundance to remunerate the oystermen, a greater or lesser number of years in succession, for the labor of gathering them, there is a natural bed as the law recognizes and protects. This is substantially the idea of those who have labored on

¹ Connecticut Shell Fisheries Commission. 1882. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.9.

the beds for many years. In their testimony before the Commissioners, a natural oyster bed with them was an uncultivated bed where they could find oysters ‘in paying quantities’ – where they could do ‘a fair day’s work’ – and this view is substantiated by legal authority.²

Connecticut’s 1881 law defined natural beds as places that had oyster in the last ten years and were not “designed or planted by man,” but this was ambiguous. The commissioners cited the Goldsborough Definition, and they used it to interpret the 1881 dispute. They claimed that although oystermen disagreed about what constituted a natural bed, the general feeling fit the Goldsborough definition of the same year.

Connecticut bed boundaries varied from year to year. The general shape and placement of the bed did not change much, but the edges moved a great deal, and since the edges were irregular, it was very hard to mark these with buoys. The commissioners’ solution was to make straight lines that enclosed the natural beds. These were larger than would be the case otherwise. These lines were placed with convenient ranges matching prominent shore objects so that it would be easier for oystermen and law enforcement officers to find them.

Connecticut’s 1881 law said that leasing could take place on old, exhausted natural beds if they had not yielded oysters for ten years. Applications arose for many of these, but oystermen presented numerous conflicting opinions about the location of former beds and the presence or absence of oysters, and the commissioners had “grave doubts” as to what to do.³ They sample-dredged many of these areas and wrote that this usually confirmed that they had been barren for a long time. However, they had to still reject these applications due to the conflicting testimony. They pointed out that these

² Connecticut Shell Fisheries Commission. 1883. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.9-10.

³ Ibid. p.11.

might be leased later though. They recommend reducing the unproductive period to five years, as this would open many areas.

The commissioners finished mapping natural beds in 1885, and recommended a law defining their boundaries. In this report they mentioned having problems determining the “south line” of the beds, which is where they became too deep to work. Their definition was “the most southerly line claimed by any oystermen who work on the natural beds.”⁴ The natural beds covered 5,805 acres. The largest were near the towns of Stratford (3,055 acres) and Fairfield (1,237 acres). No others exceeded four-hundred fifty acres. The commissioners were proud of their work, and saw it as historically important, saying:

Connecticut is putting into practice the best system of oyster culture in the world...The eyes of the world are upon Connecticut at the present time...Every country which has an oyster fishery is trying to solve the same problem, viz: ‘How to protect beds and give oyster culturists right of property in the fruit of their labors.’⁵

Their mapping dealt with the basic problem of defining natural beds by creating borders that were simplified and erred on the side of greater protection. This basic pattern helped them avoid large scale conflict over mapping, and Rhode Island’s four foot measure represented a similar approach. Both were ways to map oystermen’s pre-existing norms and practices, which were negotiated compromises. These older norms and practices were complex and hard to pin down, so the commissioners’ way of encoding this complexity was to make simplified maps. But the simplification erred on the tongs’ side, and thus did preserve the basic ideal of the older system.

⁴ Connecticut Shell Fisheries Commission. 1885. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.6.

⁵ Connecticut Shell Fisheries Commission. 1886. *Report of the Commissioners of Shell-Fisheries of Connecticut*. p.15-16.

7.3.2 Local scale mapping: New Jersey and New York

Unlike most states, little information remains on how New York mapped natural beds. Their first oyster surveys, made by Blackford, did not map them. In many places, natural beds were already exhausted and planters had moved into these areas. In others, towns had designated natural beds. Blackford recommended mapping these, but it is unclear when and how this was done.⁶ It seems to have been the province of town-scale commissions mentioned in chapter five.

In New Jersey, the first state oyster commission (1884) claimed that natural beds could not be mapped, since they shifted and changed, and its report said even surveys of planting grounds would be too expensive.⁷ This attitude toward surveys may have been part of the reason New Jersey never had a state-wide natural bed survey. Instead, New Jersey developed two alternatives. First, they had a series of smaller district surveys. Second, in Delaware and Barnegat Bays they split public and planted beds with a straight line.

In the Delaware Bay, a compromise split the Bay into north and southern sections and eventually lessened property conflicts between planters and tongers. Most natural beds were in the upper, northern portion of the bay, as oysters propagated better in the lower salinity waters. Rather than map natural beds with precision, the commission simply drew the so-called “southwest line” separating upper bay beds from lower bay waters. Environmental divisions again helped people reach a political compromise, just as they had in Rhode Island. In this case the gradual salinity gradient of the bay, coupled

⁶ Blackford, Eugene. 1885. *Report of the Commissioner of Fisheries of the State of New York, in Charge of the Oyster Investigations*. p.2.

⁷ New Jersey Oyster Commission. 1884. *Report of the Oyster Commission*. p.18.

with its lack of extensive shallow inlets, was the key factor. Delaware Bay's biggest estuary, Maurice River Cove, was the site of its largest protests and conflicts. This was because it was in the lower bay planting region, and it was close to the leading packing center, but, being an estuary, it also had extensive natural beds. If Delaware Bay had had more shallow inlets with abundant oysters, such conflicts would have increased. Instead, Delaware Bay public beds would end up sending most of their seed oysters to the planting grounds in the southern end of the bay. Barnegat Bay also divided its natural beds and clam grounds from planting areas using a similar straight line rather than precision mapping.

As stated in chapter three, Ocean and Atlantic County reports survive from New Jersey's early District Commissions, and these reports provide some of the only information on these district commissions' natural bed mapping efforts. The state commission contracted an engineer in 1900 to survey natural beds. This engineer marked beds with brass markers to aid in surveys, and these made guard work easier too, although many were placed below the high tide mark.⁸ Atlantic County's district report also mentioned setting aside clam grounds in 1905, and completing a survey of natural beds.⁹ In Ocean County, the district commission's 1903 report stated that the commissioners were beginning to map natural oyster and clam beds, but lacked adequate funds. Surveyors had problems surveying clams. Clams and oysters were about equal financially in this region, and deciding how to divide these areas was difficult and controversial, as there were many overlapping claims. Both groups also fought with planters over space. To add to the commissioners' difficulties, faulty equipment forced

⁸ New Jersey Oyster Commission. 1900. *Annual Report of the New Jersey State Oyster Commission*. p.7.

⁹ Atlantic County Oyster Commission. 1905. *Annual Report of the State Oyster Commission for the District of Atlantic County, New Jersey*.

them to abandon the survey for the year. The commissioners also admitted that this survey accidentally assigned some natural clam beds to oystermen. Predictably, this created animosity and distrust, and the commissioners wrote that many baymen thought the whole survey was being done for the benefit of the oyster industry at the expense of the clammers.¹⁰

In 1904 the Ocean County commission adjusted clam lines again in Tuckerton and Great Bay. At this time a line running from east to west divided Barnegat Bay into public and private sides. The commissioners wanted this east-west line changed to run from the north to the south, with the west side public property and the east side reserved for planting. The advantage of this was that both types of beds would be adjacent, which would make it easier to carry seed oysters to the planting beds.¹¹ This ignored bay ecology and pre-existing fishery patterns and was never adopted. By 1905, the surveys were nearing completion. The commissioners had established lines and bases that would make future surveys easier. They also reported that clammers and oystermen were happy with the re-staked clam line.¹² These few surviving district commission reports show the relative weakness of these state agencies. They were very different from the high modernist state agencies Scott describes, which is why they could not radically restructure property rights, despite occasional inclinations to do so (i.e., the north-south line). This lack of power was one reason the commission settled for straight line surveys in Barnegat Bay.

¹⁰ Ocean County Oyster Commission. 1903. *Annual Report of the State Oyster Commission for the District of Ocean County, New Jersey*.

¹¹ Ocean County Oyster Commission. 1904. *Annual Report of the State Oyster Commission for the District of Ocean County, New Jersey*.

¹² Ocean County Oyster Commission. 1905. *Annual Report of the State Oyster Commission for the District of Ocean County, New Jersey*.

A letter in a trade publication titled “Thirty Years Reminiscences of a Veteran Oyster Planter” described conflicts with the commission in Atlantic County.¹³ The author said that in 1903, ninety percent of all oystermen and clammers in Atlantic County signed a petition asking for equal rights “with that it gave Cumberland County,” which resulted in peace there. This referred to a line separating natural beds from planting areas in Delaware Bay. The legislature or the commission refused, and refused again in 1904, 1905, and 1907, despite eight hundred signatures on the 1905 petition, and despite Ocean County commissioners setting up a line at this time. The 1905 law mandated dividing clam and oyster grounds, and the author said oystermen were pleased with the old commissioners, who were “honest men.” Their work met with general approval. However, the new commissioners were leasing clammers’ grounds to oystermen, and this created conflict. The author saw this as an attempt to get more land for an eventual capitalist takeover as happened in 1894. He thought their motive was to create discontent and failure so they would give the bay to rich capitalists. This article shows the struggles for control over these small-scale commissions and their mapping efforts. It also shows local people wanted maps to help them settle disputes.

One case in particular drew ample attention in Barnegat Bay, and it highlighted why local people were interested in bureaucratizing traditional property rights. On April 27th, 1901, the local paper’s headline read “Clammer Shot Dead in Tuckerton Bay: ‘Uncle Jakie’ Stiles kills ‘Cale’ Fithian without warning or mercy, firing twice.”¹⁴ This headline was much larger than ordinary, and the paper devoted much space to the incident in this and subsequent weeks. Stiles was a watchman who had protected

¹³ *Oysterman and Fisherman*, October 1908.

¹⁴ *New Jersey Courier*, April 27, 1901.

Tuckerton oystermen's planting property for fifteen years. Fithian and a few companions were clamming and encroached on the property Stiles guarded. Stiles had told people he was going to teach the clammers a lesson before the incident, and the paper reported that there had been fights, threats, and general ill will between the two groups in Tuckerton and other places. The clammers in question had taunted Stiles in the past, and admitted they were working on planted beds. Stiles simply sailed his boat up to Fithian and shot him. He surrendered to police, saying he was not sorry and he was doing his "duty." Stiles was seventy-four and his lawyer argued he was too senile to stand trial. He was sentenced to a mental institution. The *New Jersey Courier* reported that this incident left the area in shock. It also said residents of Tuckerton and Parkertown (mostly planters and clammers respectively) would not look at each other during the trial's proceedings.¹⁵ Incidents like this were one reason oystermen and clammers were asking for a more settled system of property rights. Indeed, one letter to the editor used it to explain why Barnegat Bay needed a line like Delaware Bay's.¹⁶

7.4 Precision mapping in Chesapeake Bay

7.4.1 The Baylor Survey

James Baylor surveyed all Virginia's natural beds between 1892 and 1894. His survey results, popularly known as the "Baylor lines," are still used in Virginia oyster management. The USCGS furnished the surveyor (Baylor), instruments, and projection paper, while the USFC furnished the steamer and crew. The survey's aim was to settle disputes between planters and tongers by fixing the borders of the natural beds. To locate

¹⁵ *New Jersey Courier*, December 12, 1901.

¹⁶ *New Jersey Courier*, February 27, 1902.

the beds, a judge in each county appointed a commissioner who had long experience working the beds in his county. These three men (one for each tidewater county) were all tongers. The survey delineated 201,216.3 acres of natural beds, leaving more than 400,000 acres outside this in Virginia waters. After completing the work, Baylor reported a high demand for the thirty resulting charts; he quickly ran out of many and asked the legislature for money to print more.¹⁷

Baylor worked under a state law that required him to rely heavily on county commissioner testimony, as they were the final arbiters of bed boundaries under the law. He mapped bed boundaries as straight lines; the Baylor Survey was a “straight line” survey like the ones in northern states. Baylor mapped this way for several reasons. It made administration and policing easier. He lacked time and money for a more rigorous, detailed survey. The law also forced him to rely on tongers and err on the side of protecting tonger rights. All of this meant his straight line designations included many areas with no oysters. As the next section will show, this was not the type of survey Baylor wanted.

7.4.2 Oyster mapping and the ideology of Progressivism

Baylor’s views and goals

In Virginia, I was able to obtain detailed information on the views of the two principal surveyors: Baylor and Moore. Their views are important to this study because they wanted very different results from what they produced. Both favored expansion of leasing and limiting natural bed tonging. They hoped their surveys would make this

¹⁷ Baylor, James. 1895. *Survey of the Oyster Grounds of Virginia: report of J.B. Baylor to the Governor of Virginia*.

possible. The contrast between what they wanted and what actually happened shows a lack of control over the surveying process by the surveyors.

Their ideas also give a sense of what Progressivism meant to these surveyors. Their goals reflected a persistent interest in maximizing production, which was a key theme in oyster “high modernism” and Progressivism more generally. The Progressive goal of maximizing production or maximizing efficiency is a type of “formal rationality” because it is a quantifiable goal. Oystermen, and oyster producing states, maximize benefit, this reasoning assumes, when they maximize production, as long as they do this efficiently. They earn the most money per hour. This is formally rational because it ignores substantively rational goals, such as oystermen’s strong desire for independence. In Scott’s terms, this goal focuses on a single variable, and this makes the ethical situation seem clearer and more legible. The way forward becomes clear. The great value of the ethnographic material on Baylor and Moore, and similar material in chapters four and seven, is that it helps explain why this ethical narrowing was such a pervasive feature of Progressive Era natural resource management.

James Bowen Baylor (1849-1924) was a hydrographic and geodetic engineer who worked for the U.S. Coast and Geodetic Survey. He was a Confederate Civil War naval veteran. Among his most important jobs were resurveying the U.S.-Canada boundary line with his Canadian counterparts and resurveying the boundaries between Virginia-Tennessee and Pennsylvania-New York. His coastal work included surveying Mobile and Perdido Bays in 1892, and helping resurvey the entrance to Mobile Bay with other

parties. This work included surveying oysters. In addition to his Virginia and Alabama work, he also surveyed oysters in Louisiana in 1904.¹⁸

Several pieces of evidence provide insight into Baylor's ideas about the oyster industry. One is a set of pages held in his personal papers collection (undated, in his 1889 folder), where he wrote notes and calculations. These show how he thought about the link between education and productivity, and why he saw the need to increase productivity as a pressing issue for the southern states. The notes appear to be preparations for a report or article. Their calculations show countries' populations and literacy rates. According to his data, America produced nearly half the output of Europe, despite the latter having a larger population. Baylor attributed American productiveness to "[l]abor saving machinery and intelligence of workmen...The waste of labor in Russia is prodigious... [Russians] live out there lives in drudgery... [their poverty] is due to the ignorance of the people." He added that "[d]ensity of population has no necessary effect on the productivity of a country, or even on the rate of wages." He cited France as the country with the highest wages per capita. The note also mentioned a book by Charles W. Dabney titled, "A World Wide Law: the production of a people is in proportion to their education." Dabney was the president of University Tennessee, and Baylor also cited a speech of his titled "Education and Production" that compared Massachusetts and Tennessee as a way to advocate greater spending on education. By themselves, these notes show that Baylor thought education was the key factor in increasing productivity, but the notes do not explain if or how he might have related this to oystering.¹⁹

¹⁸ James Bowen Baylor papers, University of Virginia, Small Library Special Collections.

¹⁹ Notebook, in James Bowen Baylor papers, University of Virginia, Small Library Special Collections.

Baylor made these links explicit in a speech before the Richmond Chamber of Commerce. He began by saying the South lagged behind the North in industrial education because they could not afford better schools. Machines lessened the cost of production, but workers had to be trained in mechanical arts before labor saving machinery could spread. He mentioned a farmer whom he told to use labor saving machines as they did in the north, but who told Baylor he had tried but no one could repair them. Baylor then applauded Texas for wisely putting the sale of their huge public domain into schools. His speech then explained that the South would continue to lag behind economically until it could improve its agriculture. He then turned to oysters, saying “No product on earth or water can be more largely increased by human intelligence and labor.”²⁰ He thought Northern methods should be adopted in the South. He did not mention planting by name, but the implication would have been clear to his audience. The link between education and planting might seem less clear, but the conference where he spoke was called to launch a pro-planting education campaign, so this connection was self-evident to his listeners. When combined with the notes cited above, his writing expressed a narrative that went as follows: education improved productivity everywhere (this was a social law), the South lagged behind the North economically due to a self-perpetuating cycle of poverty and lack of education, oysters were a key place to break this cycle and move forward because production increases could happen with relatively little education and time, and education meant getting people to follow the Northern industry’s example.

This narrative put the need for education and improvement into a historical context, a common feature of many scientists’ writing on oysters. It also highlighted the stakes Baylor saw in the improvement of the oyster fishery. Even if he was exaggerating

²⁰ Baylor in Ellyson, 1894.

for his audience, he clearly thought they fit a larger pattern. Progress for the South required adopting northern industrial methods, but these required education first, and the South lacked money for schools. Oysters were a way out of this bind, because “industrial” methods, by which he meant planting, required relatively little education. Baylor’s desire to break what he saw as a cycle of Southern poverty was understandable, and it helps explain his production-oriented Progressivism. One imagines his experience of defeat by the more industrial north in the Civil War must have shaped his appreciation for the power of industrial productivity and regional competition.

A man named William Ellinger had an extensive correspondence with Baylor that was preserved in Baylor’s papers, and these shed further light on Baylor’s interest in expanding planting. Unfortunately, only Ellinger’s letters remain; there are none to him from Baylor. Their tone was always informal, except on one occasion, so the two seem to have been close. Ellinger frequently discussed their visits, and he also talked about their families’ interactions. Although Ellinger described their work together as “founded on a mutual interest,” these signs of intimacy do not mean they shared views, of course. The content of the letters is often about Ellinger’s efforts to promote planting. He wrote as though Baylor supported him in this, and often asked him for help or thanked him for it. He was clearly keeping Baylor up to date on his progress, aware that Baylor was keenly interested. All of this suggests the letters do tell us something about Baylor’s own views on planting.

Ellinger used phrases such as “the glory of our generation” when he described the eventual acceptance of oyster planting in the South.²¹ He was trying to spread acceptance by changing opinion in his own county first. He said both he and Baylor felt regret that

²¹ Letter from William Ellinger to J.B. Baylor, December 19, 1892.

“the oyster question should be the football of politics.”²² Both were also worried about oyster decline. Ellinger described this in one letter:

Sick? Yes Mr. Baylor such news as you write is contagious. It makes me sick too. I think that a class whose rapacity and wastefulness has nearly destroyed the noblest Bounty nature ever bestowed when [illegible]... reaches forth for not only what is left but claim also that which were if left to its rightful owner the Commonwealth might be made a source of profit to the citizens of the State.²³

Baylor also received letters from Haman that indicate Baylor’s support for his bill. In response to a Baylor letter, Haman said perhaps Baylor could strengthen the part of his proposed legislation on planting.²⁴ In this and other letters Haman asked Baylor’s advice on numerous matters, and asked for help organizing a movement for oyster culture. These corroborate the picture of Baylor’s desire to expand planting.

Baylor’s 1894 “Report to the Governor” was a short piece that explained the importance of planting. He claimed that 95% of Europe’s oysters came from artificial beds. In Virginia, opposition to planting would die out, he wrote, and tongers would feel more inclined than ever to plant. He expressed the yeoman ideal so important to Virginian culture, saying “[t]he ideal system would be to have the oyster area divided as much as possible into small farms.”²⁵

Baylor also wrote a series of letters to the *Richmond Times*. In these he noted that “much feeling” was aroused when oystering was discussed in tidewater counties. This was a shame since “public opinion can override any law,” even a good one.²⁶ He defined a good (oyster) law as one that followed the Progressive maxim that “[t]he greatest good

²² Ibid.

²³ Letter from William Ellinger to J.B. Baylor, May 30, 1893.

²⁴ Letter from B. Howard Haman to J.B. Baylor, October 27, 1905.

²⁵ Baylor, 1895. p.6.

²⁶ *Richmond Times*, December 4, 1892.

to the greatest number is the humanitarian aim of government.”²⁷ In these letters he provided a lengthy discussion of the Northern industry, and said Virginia had several natural advantages, although, he said, Virginia did have less access to markets. In another letter, he explained the problem with the oyster commons:

These were the common rights of the first settlers. This is the usage in all new communities. As man advances in civilizations the policy is to assign to the individual everything susceptible of ownership. Thus only can human energy and enterprise be encouraged, the material wealth of the country increased, opportunity for full development of mind and body obtained, and what is called civilization made possible.²⁸

The current property system maintained poverty. It was the “height of folly in this progressive age.”²⁹ He stressed that people kept them a commons solely because they had been one in the past. But, he said, tradition was no argument because everything was a commons once. Tongers should display “cheerful acquiescence” to the inevitable change.³⁰ Virginia could never compete with interior states in producing staple agricultural crops, but they could compete with anyone in oysters.

His discussion of natural beds was a little more ambiguous. In one letter he said that natural beds should remain state or public property and should be carefully regulated, as they are the spat producing beds, and he went on to say tongers must make money from natural beds “until they are induced to become small oyster planters.”³¹ He said natural beds should be preserved, but this could only be done if planting expanded to take stress off them.

²⁷ Ibid.

²⁸ *Richmond Times*, December 18, 1892.

²⁹ Ibid.

³⁰ Ibid.

³¹ *Richmond Times*, January 28, 1893.

Baylor combined historical narratives about the inevitability and superiority of private property with Southern concerns over lack of industry and competitiveness. All of this hinged on equating progress with productivity. It was not that he thought everything that was good could be measured this way, but progress for society depended on increasing output per unit of labor. This was the more important accomplishment.

Moore's views and goals

Information on Moore's views come from a paper he read to the Fishery Congress in Tampa, FL, in the summer of 1899, titled "Some factors in the oyster problem." He outlined the problem as follows:

I can see no hope for the continued productiveness of our natural beds if they are made to bear the brunt of the yearly increasing demand...Those who have studied the problem are a unit in the belief that the solution lies in the general adoption of oyster culture under private ownership and as a result of private enterprise. The Government can do but little. Wise laws rigidly and judiciously enforced can stimulate private ventures and retard reckless waste of public possessions, but our oyster beds can never be repopulated by the methods which have in many cases proven so beneficial in restocking out streams with food and game fish.³²

He described Gulf Coast conditions related to oyster culture.

As for solutions, he advocated cull laws and closed seasons. He did not advocate artificial propagation, stating that "The methods of fish culture are not now, and probably never will be, available in propagating the oyster."³³ He believed fish culture was proper work for the government because fish disperse and were caught by people who did not grow them, which removed incentives for private propagation work. But oysters remained where planted, and so propagation would be better handled by the private sectors, if it were to prove feasible.

³² *Fishing Gazette*, July 22, 1899.

³³ *Ibid.*

Moore also discussed the property question. He said,

The logic of our history would dictate the throwing of the tidelands open for occupation, yet in how many states are the laws, and more especially public opinion, practically if not intentionally prohibitive? A policy far different from that in land above tides is supposed to be justified in dealing with that portion of the State's domain lying beneath the sea. There is a reluctance to part with the tide lands, and it is thought preferable to allow them to lie barren rather than to permit individuals to acquire permanent possession. There can be no doubt the best results are obtained when the oyster grower holds his lands in fee simple.³⁴

He also said that “[t]hrifty citizens...will hold aloof” without private property rights, because they feared tongers would steal their oysters.³⁵ He thought the government should tax sales and not property, to improve incentives for people to begin cultivation.

Moore then asked how this could be brought about. He cited Connecticut's success, saying that while it was due in part to market proximity, an important consideration for his southern audience, it was also due to their citizens' industry and “enlightened public opinion.” He noted that industry was found elsewhere too, but “enlightened public opinion” was in shorter supply:

Adverse public opinion...is one of the greatest difficulties with which he [the planter] has to contend. Theft of property beneath the tide is palliated by some as an act of retributory justice against a common enemy, and a man who will steal oysters would scorn to enter his neighbor's poultry house. This peculiar moral obliquity is rooted in ignorance, and must be combated by education, supplemented by more than occasional salutary castigation from the strong arm of the law.³⁶

Moore, like Baylor and the high modernist advisors in chapter four, saw private property as a requirement for progress because of imagined social laws. Moore saw planting as a remedy for oyster decline because he thought it was more productive than the tonging fishery.

³⁴ Ibid.

³⁵ Ibid.

³⁶ Ibid.

7.4.3 Moore's James River re-survey

Baylor wanted a different set of maps than the ones he produced. He wanted maps that limited natural beds as much as possible and thereby opened more areas to planters. He thought his survey was better than nothing and a decent temporary measure, but he wanted to go back and fix it. The state legislature never funded another survey. The USFC did fund one however. Henry Frank Moore re-surveyed the James River in July-September of 1909. Moore's goal was to open many areas within the Baylor lines to planting by showing they lacked natural beds (see figures 7.1 and 7.2 for pictures of Moore's map).

To "fix" the Baylor survey, Moore needed to make his work more scientific and objective than Baylor's. Moore used sextants and three-armed protractors, not as accurate as "the best theodolites" used by the USCGS, but quite sufficient for this work. He located beds by dragging a chain line with a copper wire. The wire vibrated when drawn over shells, and he recorded these locations. The ship ran transects. They checked their position by two sextant readings every two to three minutes, reading three signals as they moved (one in the middle, two on each side, so that two angles change as they move). They took a sounding every twenty seconds and sampled the bottom character (hardness) and the wire record taken for that section. The wire measurement recorded oysters as either "barren, scattered, or numerous." If they recorded numerous oysters, they dropped a numbered buoy and a second boat would tong up a sample, taking a standard number of grabs per distance. The surveyors made measures of the areas grabbed by tongs at various depths, and this was used to adjust the data. Tongs cover less area with depth, which made it look like there were fewer oysters in deeper waters than there really are. This

method gave an exact record of conditions that they could map with a few yards. For the entire survey, the trailing boat made 590 buoy examinations, while the lead ship took 10,440 soundings, used 1,369 instrument reading locations, and chain dragged 226 transect miles.³⁷

Following the Goldsborough definition, Moore then converted his data into a map of the natural beds by developing an economic measure. He divided the beds by the number of bushels a tonger could take in nine hours. This was a function of density and depth. In other words, a tonger could gather more oysters faster in shallow water, so a natural bed needed lesser densities to support a tonger if it were shallow. Moore and his team observed how fast tongers worked to develop these metrics. In his report he provided an estimate of density needed to make a living given recent prices.³⁸ Moore avoided discussing in detail what constitutes a livelihood, as he felt this was a judicial matter, but he had to use some standard in classifying productive regions.³⁹

Due to division of labor, and by design, no one could know the results until the data were compiled at the end. “The author himself [Moore] could form but a vague idea of the general results until the charts were completed and the results almost written,” which Moore felt helped avoid bias.⁴⁰ The results indicated that natural beds were formerly more distinct. Their outlines had become less sharp and they had often expanded or merged due to dredging. Many areas with few oysters listed as “depleted” were in fact new areas with scattered shells created by dredging, although some of these were already over-worked too.

³⁷ Moore, H. F. 1911. Condition and Extent of the Oyster Beds of James River, Virginia, 1909. In USFC. *Report of the Commissioner of Fish and Fisheries for the year 1909.*

³⁸ Ibid. p.58-59.

³⁹ Ibid. p.80.

⁴⁰ Ibid. p.13.

Moore's study was undertaken in large part due to disputes over barren bottoms within designated public beds. In addition, some private beds were found within the public bed boundary established by the Baylor survey, although it was difficult to say exactly where some of the private boundaries were due to "the flimsy nature" of their markers.⁴¹ Baylor boundaries were poorly marked in 1909, and several of Baylor's shore reference markers were gone by this point.

Out of 26,408.4 acres within the Baylor lines, Moore classified 3,227 as "dense growth," 2,078 as "scattering," 1,848 as "very scattering," 3,884 as "depleted," and 15,371.4 as "barren." In other words, only 27% (7,153 acres) was productive, and 58% (15,371 acres) was devoid of oysters. Moore's report stated that he favored opening these barren areas to leasing, but only when this would not present a large enforcement problem.⁴²

Despite Moore's rigorous methodology, which was a model for later natural bed surveyors, the Virginia legislature never used his survey. It had no impact on management at all. Both Moore and Baylor favored expanded planting and decreased tonging. They hoped their surveys would pave the way for this. However, this was not what happened. Baylor was forced by legal and time constraints to adopt procedures that designated buffers around the natural beds. The areas set aside for natural beds were larger than he wanted. Moore fixed this, but his survey was rejected because it was politically unacceptable. The cases show that surveys codified traditional political compromises, and they did this in spite of the more high modernist views of some of the surveyors.

⁴¹ Ibid. p.57.

⁴² Ibid. p.82.

7.5 Maps to change behavior

7.5.1 The Yates Survey

Maryland's Yates Survey was the most extensive natural bed survey during this period, and remains the most painstaking and thorough biogeography survey of oyster beds in U.S. history. It took seven years. The result was a 2,400 page document, with forty three large maps. Its boundaries remained the legal boundaries for Maryland oysters, with minor modification, until 1983. H. F. Moore represented the USFC as an advisor and the Maryland state government funded the project.

Charles Yates wanted his survey to change behavior. At the outset of the survey he nailed a sign to the mast of his ship that read "A survey that does not lead to legislation is a failure."⁴³ This indicated his sense that surveys not only clarified property rights but also revealed the true state of the resources and fishery, and his expectation was that when this was seen, legislators and public opinion would respond rationally. This was an educational ideal for surveys, and it was based on the assumption that rational actors would respond predictably and to accurate information. Moore had the same goal for this survey; he hoped it would induce policy change. This goal required mapping projects with detailed statistical picturing, and not the broad, straight line surveys of the northern states.

The passage of the Haman Act in 1906 required Maryland to map its natural beds so that leasing could proceed in other areas. Yates, who worked for the USCGS, carried out this survey. The Yates Survey took the opposite approach to surveys from New Jersey north. These used broad, simple lines to separate beds. This solution was

⁴³ Ibid. p.20.

impossible in Maryland. The bays were too shallow to separate areas based on depth, as in Rhode Island. The beds were spread out by years of dredging, and they were the largest beds to start with, so there were few places that were completely free of oysters. The commissioners could not divide the bays with simple lines, but they still needed to somehow protect tongers' rights in order to gain support for planting. Tonger support was critical in Maryland, due to tidewater votes mattering more in the legislature and due to the sheer number of tongers. The commissioners' alternative to simple lines and broad divisions was a thorough, transparent process that used science to accurately map the beds.

Yates used methods developed by Caswell Graves, one of Maryland's oyster commissioners. Yates relied on the Goldsborough Definition, but noted

Before this definition could be of use in determining, accurately and scientifically, the status of an oyster ground, it was necessary to expand its central idea, "livelihood," into accurately determinable factors and to combine these factors into a practical scheme for investigating and determining the condition of the grounds under consideration.⁴⁴

To do this he split "livelihood" into constituent factors: income, price, oysters, time, and area. He adopted a low estimate of the income needed, which increased the area of natural beds. He did not explain how he arrived at an estimate of what wages people needed. To determine the time it took to harvest this quantity of oysters, he asked oystermen and consulted weather records to see how long they spent at sea. He then took careful "grab" measurements. These measured how many oysters one generally caught in the tongs, which allowed him to calibrate his sampling methods to the definition he was developing. He came up with three sets of figures: one for hand tongers, another for patent tongs, and a third for dredges (who need fewer oysters per acre). Most of his

⁴⁴ Maryland Shell Fish Commission. 1912. *Fourth Report of the Shell Fish Commission of Maryland*. p.49.

figures were based on work in Anne Arundel County, as that was where the survey started, and the report said nothing happened in other counties to make them change their measures.⁴⁵

Once he had established this economic definition, the next task was measuring the boundaries of natural beds. The survey vessel towed a cable, and a person on board holding it would detect hard objects on the bottom by the vibrations of the cable. When they detected hard objects, the crew would take samples to see if the objects were oysters. Measuring the density of the beds involved taking samples at regular intervals along a transect path, and then counting the oysters taken from a standardized sampling technique. Yates then extrapolated these figure for the entire area of the oyster bed.

The spirit of the law guiding his work was “towards the Free Fishery,” and Yates tried to always give the tongs the benefit of the doubt, both in developing his measurement and in the actual mapping process. He knew that securing acceptance of the survey was the only way the tonger would ever allow planting, so he hired local tongs to operate the tongs on the surveys efficiently by bringing their knowledge and expertise. He also wrote that he hoped tonger participation would create buy-in. The tongs also helped say where to make examinations.⁴⁶

Yates’ team used several types of maps. On board they used “boat sheets” that showed areas that were thought to be oyster bars. They also brought projection maps that had the triangulation points, and they plotted bars on them. Yates then published charts of the bars and stations, and the commission printed these and made these available to the

⁴⁵ Ibid. p.49-51.

⁴⁶ Ibid. p.83.

public. There were also “progress maps” (I am not sure what these were). The final products were the leasing charts, which were published in or after 1912.

Yates also actively worked on legislation. He assisted in writing legislation on the Haman amendments and Campbell-Price Bill. The Commissioners were constantly asking his advice on all matters and oyster navy captain Frank Seth did as well. Yates’ interaction with the legislature began at the start of his work.

As chapter five made clear, the Haman Act failed to expand leasing significantly, as its opponents in the legislature weakened its provisions. Yates’ mapping project failed to sway the Haman Act’s opponents. It was an example of a failed attempt at governmentality. It changed the opinions of neither legislatures nor public opinion. Literature by geographers explores how this type of mapping project empowered capitalists, experts, and the state. The Yates Survey strayed too far from tidewater oystermen’s politics, so it failed to empower capitalists. It did give power to the state, but, because of on-going litigation, it only conferred power to them in a limited way that preserved tongers’ rights. In this way, the survey’s fate was much like Moore’s. The two most detailed Progressive Era oyster surveys were guided by a sense that accurate resource maps change behavior, and both failed to have this effect.

7.5.2 Southern surveys

In the Southern states, a different type of survey tried to change behavior much more successfully. These surveys mapped so-called “barren bottoms,” or places without oysters. They also mapped environmental conditions to show where oyster planting should proceed. The most important condition they mapped was the bottom sediment.

Oyster larvae cannot survive if they land on thick, muddy sediment, so planting would be pointless in these areas. The goal was to stimulate the planting industry and guide it in areas where it was in its infancy. The USFC did all barren bottom surveys, although sometimes they worked in conjunction with state agencies. This fit the USFC's larger goal of expanding economic development that guided them at this time. Some historians argue that promoting economic development was the chief aim of the federal fisheries agency up until WWII.⁴⁷ Since the goal was to promote oyster culture in places it did not yet exist, these surveys took place in the states south of Virginia (see figure 7.3 and 7.4 for an example of a southern survey map).

Francis Winslow was again the first person to do this type of survey. Winslow expressed both of the barren bottom survey goals. When corresponding with the USFC, he said it "seems desirable to open new fields to the oyster growers, especially those of the Chesapeake Bay."⁴⁸ He hoped to find these in the North Carolina Sounds. In another letter to Spencer Baird he explained the other role for surveys. When Winslow was in Connecticut, he noticed the widespread impression among oystermen at New Haven that the whole of Long Island Sound would be taken up for oyster farms. Many people were taking up areas unsuitable for cultivation, in Winslow's opinion, and were bound to lose money:

No one along the Connecticut shore appears to realize that the food supply is one of the most important things to be considered; the general impression is that there is food enough for all the oysters that can be put in the water. I feel sure that the Connecticut people make a great mistake and this feeling is the cause for my calling your attention to the matter. It does not appear to me to be a difficult matter to

⁴⁷ Weber, Michael L. 2002. *From Abundance to Scarcity: the History of the National Marine Fisheries Service*. Washington, D.C.: Island Press.

⁴⁸ Letter from Francis Winslow to Spencer Baird, July 18, 1882. National Archives.

investigate the character of the waters of the Sound...and ascertain the comparative richness of various localities.⁴⁹

His ideal for this type of survey was to “indicate approximately the limits of oyster culture.”⁵⁰

Winslow never did this work in Connecticut, but he did inaugurate this type of survey in North Carolina. In 1883, Baird instructed Winslow to “procure information desired as to location and extent of the oyster beds.”⁵¹ Winslow reported finding people helpful, but otherwise no information exists on this survey. Winslow re-surveyed their natural beds and planting lots after a new North Carolina law passed in 1887. The law established a board to regulate the industry. It accepted the natural beds as a legal entity open to the public, contained a revised definition of “natural beds,” and provided a period of public debate over the location of these. It was modeled on Connecticut’s law. The board (three members) traveled to coastal towns and held public meetings on the location of these natural beds. Winslow felt these meetings changed everyone’s perception:

“Where widespread ignorance as to the real condition of matters existed in the past, intelligent comprehension of all phases of the question is to be found in the present.”⁵² This led to “harmony,” whereas the past was characterized by “robbery of the common property by one class, and depredations on the private property by the other.”⁵³

Winslow’s second survey was a natural bed survey designed to fix natural bed property boundaries. County commissioners were to help him with these property surveys, but they did not always do this, and the lots registered by them were “rude in the

⁴⁹ Letter from Francis Winslow to Spencer Baird, August 5, 1882. National Archives.

⁵⁰ Ibid.

⁵¹ Letter from Spencer Baird to Francis Winslow, February 19, 1883. National Archives.

⁵² Winslow, Francis. 1887. Report of the sounds and estuaries of North Carolina, with reference to oyster culture. In *United States Coast and Geodetic Survey Bulletin No. 10*. Washington D.C.: Government Printing Office. p.136.

⁵³ Ibid. p.132.

extreme,” often drawn by hand or simply mentioning the general area where they were. Winslow reported that only about three or four farmed plots were then harvested profitably out of about two hundred and fifty, and these few had their “property secured by a gun.”⁵⁴ Winslow’s second North Carolina survey was thus a natural bed survey like the ones discussed so far. As with natural bed surveys, Winslow again provided a prototype, the 1883 survey, which was cruder than later work and left fewer traces in remaining primary sources.

The USFC’s next barren bottom survey was in Georgia in 1889-90. Drake mapped bottom conditions, as mud was seen as the main obstacle to cultivation.⁵⁵ Battle mapped South Carolina waters in 1890-91.⁵⁶ He measured natural beds, bottom type, specific gravity, and he did some chemical analysis of the water. Battle had worked with Winslow in North Carolina and with Drake in Georgia. Battle found that about one fourth of the area surveyed was suitable for planting. After this there was a hiatus until 1896, when Swift preformed a survey of natural beds and bottom conditions in St. Vincent Sound in Apalachicola Bay and St. George’s Sound in Florida.⁵⁷ Caswell Grave also started a study in North Carolina in 1899-1900 that aimed to map natural beds, and to study them and planted areas to see why some were more successful than others. He also wanted to study bottom conditions and industry economics. His work was done in conjunction with planting experiments carried on by the North Carolina Geological

⁵⁴ Ibid. p.127.

⁵⁵ Drake, J.C. 1890. On the sounds and estuaries of Georgia, with reference to oyster culture. In *United States Coast and Geodetic Survey, Bulletin No. 19*. Washington D.C.: Government Printing Office.

⁵⁶ Battle, John D. 1890. An investigation of the coast waters of South Carolina with reference to oyster culture. In *Bulletin of the United States Fish Commission, No. 10*. Washington D.C.: Government Printing Office.

⁵⁷ Swift, Franklin. 1897. Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George's Sound, Florida. In *Report of the Commissioner of Fish and Fisheries for the year ending 1896*. Washington D.C.: Government Printing Office.

Survey.⁵⁸ In 1898, Moore began working in Louisiana.⁵⁹ He would later perform surveys across the Southeast, and he would strengthen the methodology of the surveys, creating a standard model that was widely followed.

Moore began surveying Southern states regularly in 1910. His techniques were similar to what he developed earlier in the James River and Louisiana. These allowed him to map both natural bed and barren bottom conditions. Louisiana was a special case. It had the fastest growing oyster industry at the time it was first surveyed in 1898, but was still small by northern standards. The surveys ran into problems mapping property rights around the Mississippi Delta. It was too flat to have any landmarks, and signal stations were quickly wiped out by hurricanes and shifting channels. The environment was so dynamic that even if a lease was accurately marked somehow, it could be covered with sediment so quickly that it might become land. Surveyors overcame these problems and the result was the Louisiana continued to grow and eventually rose to rival northern oyster grounds. Florida's oyster fishery also grew rapidly following USFC barren bottom surveys.

These southern surveys were true "frontier" mapping projects, filling in blank spaces on maps. They also explicitly mapped what was not there; they mapped the landscape's potential and thus sought to shape how people saw and used the areas. The investment that followed the maps shows that they successfully changed people's perception. These investments failed in some places, but in general the maps were instrumental in founding a new industry that provided livelihoods to numerous coastal

⁵⁸ Grave, Caswell. 1905. Investigations for the promotion of the oyster industry of North Carolina. In *Report of the Commissioner of Fish and Fisheries for the year 1903*. Washington D.C.: Government Printing Office.

⁵⁹ Moore, H.F. 1899. Report on the oyster beds of Louisiana. In *Report of the Commissioner of Fish and Fisheries for the year 1898*. Washington D.C.: Government Printing Office.

towns. The industry that grew out of this did have some concentration of wealth in the packing houses and larger oyster farms, but most of the oystermen remained the marine equivalent of small farmers. This was partly due to the recommendations of the surveyors. They repeatedly included laws from northern states (usually Connecticut) in their reports to the state legislatures, and they usually recommended provisions to prevent monopolies, such as limits on the size of leases and guarantees of access to the public beds.

Unlike the Yates Survey and Moore's James River work, the barren bottom maps successfully produced governmentality. Unlike most of the literature on governmentality though, they did so in a way that was larger beneficial. State sponsored legibility projects could facilitate all manner of projects. In Louisiana's case they helped found a large and important fishery that thrived until Hurricane Katrina destroyed its oyster beds and boats. Governmentality projects pose problems when they are guided by questionable ethics, as in Moore's James River survey. In the barren bottom surveys, there was nothing particularly objectionable about what everyone wanted, and there was little in the way of a pre-existing fishery with its own politics to deal with.

7.6 Discussion: rationalizing tradition

The major problem confronting shellfish commissioners in this chapter and the last was conflict over space between planters and tongers. One major solution was to clearly mark and map each group's property, including tongers' natural beds. Tongers participated in making these maps, and even called for them in some cases, but the mapping process began with the commissioners. It required modernizing or

bureaucratizing the traditional compromise between planters and tongers, and this relied on a new form of knowledge production that was more rational, standardized and quantitative than previous understanding of natural bed locations. The difficulty was that natural beds were underwater, and their indistinct, shifting borders made them hard to map. More importantly, the concept of a “natural bed” was a social construct. The courts and commissions divided beds into workable and unworkable areas based on an idea of livelihood, and there was no method that could reduce this as an objective measure. Commissioners developed two solutions and two kinds of maps to address this problem: simple, straight lines on the one hand, and detailed, accurate, scientific maps on the other.

The literature on the cultural history of cartography has productively used post-structural theory to read maps as “texts,” looking for the meaning they embody.⁶⁰ It has more recently joined this to theories of governmentality to show how maps constitute reality in such a way that it shapes people’s perception and guides behavior into more rational channels.⁶¹ This interpretive framework fits the high modernist mapping projects, but not their populist counterparts. This chapter examines the difference and competition between high modernist and populist ideas and the way these co-produced different kinds of cartographic knowledge.

The more “scientific” Yates and Moore surveys in the Chesapeake Bay fit the high modernist pattern seen in the geography literature on governmentality. These cartographers centralized knowledge, and they produced new ways of seeing and “valuing environments.”⁶² They sought to expand conservation, capitalism, and

⁶⁰ Harley, 2001.

⁶¹ Braun, 2000. Demeritt, 2001.

⁶² Kirsch, 2002.

government control simultaneously. They “appropriated indigenous knowledge”⁶³ through their reliance on tongers as guides. Most importantly, as in Moore’s case, they used scientific cartography methods to create a map that legitimated their own perception of planting’s superiority to tonging. Moore’s maps, and Yates’, were social constructions of nature that tried to create and serve a more orderly and efficient management system that would expand planting, and decrease tonging as much as possible. Unlike maps studied by most historical geographers however, these were rejected for use by state leasing bodies. This shows that oystermen had an impact on the adoption and use, of these maps. They affected the content of Baylor’s map as well.

The “straight line” surveys that oystermen accepted depart from the geography and governmentality literature. These mapping efforts also relied on oystermen’s knowledge and they also centralized it. They also produced graphic images of nature and property that were designed to prompt more orderly behavior. They allocated space for capitalist expansion too. The difference was in the way they combined cartographic methods with traditional ethics. The straight line maps sought to preserve and bureaucratize traditional property rights, whereas the high modernist maps tried to “improve” property dispensation. This comparison indicates that the new techniques of cartographic knowledge production could be used for a variety of ends.

⁶³ Burnett, 2000.

Chapter eight: sanitation science

8.1 Introduction: mapping disease

This chapter looks at the scientific efforts to understand the relationship between oysters and typhoid, and efforts to regulate the industry in accordance with this new knowledge. This new knowledge focused on visibility too, in this case visibility of bacteria. Typhoid is caused by the bacterium *Salmonella Typhi*.¹ The bacterium lives in the digestive tract, and leaves the body with the stool. It is spread by contaminated food or water. The infection causes high fever with potentially fatal complications.

Efforts to lessen typhoid were part of larger efforts to address urban sanitation.² Typhoid rates were closely linked to urban water quality in the U.S., and they declined in the Progressive Era as municipal water quality improved. Early effort to clean cities hurt the oyster fishery though. Most cities believed in the dilution methods of cleaning water. In this method, cities emptied sewers into bodies of water and believed that mixing with this water reduced sewage to safe concentrations. It was the commonest way of treating sewage in 1880, and it was especially appealing to coastal cities.³ It was cheap and had much scientific backing. As sanitary engineers improved municipal drinking water supplies by building underground sewer lines, cities used coastal bays more and more as sewage sinks, leading to typhoid outbreaks from contaminated oysters.

These efforts were part of the “bacteriological revolution” in urban sanitation that began in the 1880s, which required a new type of expert and knowledge production.⁴ The new knowledge of sanitary scientists made disease and transmission patterns visible.

¹ *S. typhi* was known as *B. thypus* during the time period covered in this study.

² Melosi, Martin V. 2000. *The sanitary city: Urban infrastructure in American from colonial times to the present*. Baltimore: Johns Hopkins Press.

³ Ibid. p.163.

⁴ Ibid. p.138.

Scientists' first step was identifying the bacterium that caused typhoid, which they rapidly accomplished. After this scientists tried to make safety and risk visible. They did this by establishing sanitary standards and then conducting sanitary surveys. Surveys needed to test oysters in the water and in the packing houses. Both lead to certification. Certification was the end product of their efforts and it not only made safety visible to the state (and other scientists), it more importantly made it visible for consumers. As more of an average person's purchases came from sources they would never see or know first hand, and as industry released more invisible toxins, people needed way to establish trust in what they bought. Many groups could help perform this role, but all had to make product quality visible to consumers through something analogous to a certification process. This was another way interactions shifted to a larger (usually state) scale in the Progressive Era.

One of the key questions in this process is who controlled certification and to what end did they put it. This process was a key site of struggle in environmental reforms and consumer protection more generally. This pattern closely followed the one seen in chapter three over the exclusion of polluters from sinks. However in the oyster sanitation case there was very little conflict, as everyone had the same interests. The oyster certification process was controlled almost entirely by scientists – they set standards and mapping practices, and their debates were almost entirely internal. These efforts required determining, and then mapping, sanitary standards for oyster consumption. This involved them in trying to set thresholds of acceptable contamination levels. They debated these for years, as there was no exact way to set them. Levels of acceptable risk were ultimately personal or political due to inherent uncertainty. This was a visibility project

that required reducing safety to a single quantifiable variable (the amount of bacteria) to derive a level of certainty that was impossible. It was, in its own way, a high modernist project. It may have been less than 100% scientifically rigorous, but it did help protect public health. It worked due to what Scott calls the *métis*, or practical knowledge, of sanitary scientists; their standards were based on scientists' long experience and local knowledge. In this case, the ethical simplification was to see science as able to provide sanitary policy without reference to other ideals. As in chapter four, it required science to act as a guide to a political question (i.e., thresholds where pollutants create unacceptable risks). In chapter four oyster commissioners used science to quickly arrive at one "objective" course of action (i.e., privatization), but in this case scientists spent decades debating and refining standards.

8.2 Typhoid and oysters: making common sense scientific

In Europe, scientists (and non-scientists) suspected that oysters could transmit typhoid for a long time. Pasquier's 1816 book, "Oysters from a Medical Point of View," was the first scientific text to link oysters and typhoid, describing an outbreak from oysters kept near a garrison's latrines. Occasional European accounts of outbreaks mentioned oysters, but the first investigation in a scientific paper was an Irish study in 1880. The first U.S. investigation occurred after an outbreak in New Haven in 1886. Scientists tested the water supply, which was pure, and suspected oysters were the cause, but could not prove it.⁵

The first case to prove oyster could carry the disease followed an outbreak at Wesleyan College in 1894 that killed three students. Scientists at the college eliminated

⁵ *New York Times*, November 15, 1886.

all other sources and traced the disease to raw oysters eaten at initiation dinners. These oysters all came from the same dealer. The oysterman had grown them in Long Island Sound, but he had floated them near his house in a small creek about four hundred feet downstream from his sewer pipe. His wife and daughter had been ill with typhoid (the wife died) just before he sold the oysters. This case was widely reported. The *New York Times* followed it closely, and subsequent scientific reports referred to it as the first time the oyster-typhoid link was conclusively proven. Journal articles by the scientists involved make the same point. The scientists' methods involved simple detective work combined with microscopes and germ culture. They took samples from wells and milk supplies, and cultured these, then observed them under microscopes. However, as the scientists said in their articles, this was not really necessary as they could reject these sources due to the pattern of contagion. The one thing all the victims shared, as they dined at different houses, was oysters. The rest of their dinners were different enough to rule out other food sources. Once the scientists homed in on oysters, they talked to the dealer and established the obvious cause. Laboratory practices contributed little to the case.⁶

Consumers reacted to this outbreak by curtailing oyster purchases, establishing a pattern that would lower sales sporadically but steadily over the next three decades. Newspapers discussed a parallel belief, and it is difficult to judge how prevalent this was, that salt water killed typhoid, which made oysters safe. This view appeared in articles periodically, but went away as evidence accumulated. Recommendations also started appearing in newspapers at this point telling consumers to cook oysters, as high

⁶ Fuller, Caleb Allen. 1905. The distribution of sewage in the waters of Narragansett Bay, with especial reference to the contamination of the oyster beds. In *Report of the Commissioner of Fish and Fisheries for the year 1904*. Washington D.C.: Government Printing Office.

temperature was thought, with some accuracy, to kill *S. typhi*. An example was an article in the *New York Times* titled “A lesson to housekeepers in the Middletown epidemic.” It was addressed to women, and stresses how hard it was to know where food came from, saying, “[p]robably only official inspection, backed by law, can protect us from impure food.” It advised women to cook oysters to kill microbes. It pointed out that the wife of the grower in the Wesleyan case had died from typhoid too. It concluded by saying, “[i]t is most difficult to teach persons the great truth that there is duty beyond caring for the sick – that of protecting those who are well. In these days of enlightenment there is no excuse for this selfish ignorance.”⁷

After the Wesleyan case, government agencies and their scientists began studying oysters from a sanitary perspective. These studies took two paths. One was a series of scientific studies, both in the lab and in the field, that produced a body of knowledge on the bacteriology of the oyster, with all attention focused on *S. typhi*. The other was a set of sanitary surveys.

As with artificial cultivation, oyster bacteriology started in Europe. The 1880 Irish paper mentioned above inaugurated the modern bacteriology of the oyster. In 1889 de Giaksa, from Pisa, studied how long *S. typhi* could live in salt water, and since it could survive for several days he stated that it could be transmitted by oysters in water within their shell. European scientists continued to study the problem, especially after the Wesleyan case, and these early works culminated in Bulstrode’s classic “Oysters Culture in Relation to Disease” in 1896.⁸

⁷ *New York Times*, November, 1, 1894.

⁸ Fuller, 1905.

As in artificial cultivation, U.S. scientists initially lagged behind their European counterparts, but they began studying oyster bacteriology more intensively after the Wesleyan case. Fuller's 1905 review summarized U.S. and European knowledge at the time.⁹ There had been six studies of *S. typhi*'s longevity in sea water, a subject chosen for its relevance to shellfish, which ranged from nine to twenty one days. There were several studies that showed it could be displaced from oysters by placing them in a current of clean running water, but this took up to a week or more. Several studies showed that cooking oysters did not kill all germs. A few scientists established that *E. coli* was not naturally found in oysters (see below for the use of *E. coli* as a surrogate).¹⁰ Scientists also found that neither *S. typhi* nor *E. coli* multiplied in oysters, although they did move into the oyster itself, not just the water within the shell. *S. typhi* seemed to live about as long as *E. coli* in water. The first decade of studies established all the basic information needed to understand the link between typhoid and oysters. They also confirmed widely held common sense suspicions. In the 1910s, scientists continued to study how temperature and time changed the concentration of *E. coli* in contaminated oysters and sea water. The other important topic was perfecting methods for detecting *S. typhi* in oysters.¹¹ By the 1920's, oyster bacteriology had blossomed into an extensive subfield.¹²

8.3 Modern sanitary management: surveillance, standards, and certification

The first pollution survey was conducted to gather evidence for an 1860 case where oyster growers sued a Providence, Rhode Island oil company, but typhoid surveys

⁹ Ibid.

¹⁰ *E. coli* was known as *B. coli* during this time period.

¹¹ Gage, Stephen. 1910. Methods of testing shellfish for pollution. *Science* 2 (31): 548-549.

¹² Galtsoff, 1972.

began in the 1890s and spread rapidly following the Wesleyan outbreak. These surveys are much harder to trace in the primary literature than are the mapping efforts described in chapters five and six. Many more agencies were involved; there were at least four in New York City alone. Some surveys were more informal in nature, and surveyors did not create maps of many of these, or at least not ones that survive. The regulations resulting from the surveys were sometimes set and implemented by local government bodies that had jurisdiction over sewage, or by local oyster inspectors, and these small scale regulations are equally difficult to unearth. Generally there are no preserved primary sources from these low-level officials, and one must glean information from scattered newspaper accounts in several states. Nonetheless, it is possible to recreate a general picture of what surveyors did and how this affected regulations between the 1894 Wesleyan outbreak and the 1924-5 outbreak, which was America's largest oyster-caused typhoid outbreak, killing over one hundred persons.

Sanitary surveys sought to discover the presence of *S. typhi* in oysters. However, *S. typhi* was difficult to detect, so *E. coli* was used as a surrogate. Both enter water via human waste, and the two are similar enough that if *S. typhi* is present the more common *E. coli* will be too. This assumes, of course, that there are typhoid cases present; if none were, then obviously it would not enter the water supply and *E. coli* would be present by itself. But typhoid was common enough that someone in a given city would have it and thus the risk would be there. Even if they disposed of their waste in a sanitary way when they were sick, they would still have the organism in them during the incubation period and for a varying amount of time when they convalesced. Tracing *E. coli* concentrations in water was thus a way of mapping pollution from sewage, which

was a sensible way of trying to gauge whether water and oysters might be carrying typhoid.

New York's first sanitary surveys began shortly after the Wesleyan case. The New York Fish Commission sponsored an investigation in 1895 by H. W. Conn and W. O. Atwater, who recommended the state ban "floating" near sewers. Floating was the practice of placing oysters in low salinity water near creeks or coasts as a way to prepare them or store them for market. It made oysters plumper and caused them to expel sediment, but near cities, it brought them in contact with sewage. The *New York Times* reported that this caused much alarm and damaged the state's oyster industry. Following this study, the Commission asked the state chief oyster inspector, Joseph W. Mesereau, to also investigate New York's floating industry to allay fears. In his report, Mesereau called floating next to sewers a "reprehensible act, which I believe to be without precedent in the history of oyster culture."¹³ He also ordered a stop to floating at Mill Creek, Staten Island, and this was, in his opinion, the only dangerous place in New York State. The alarm caused by Conn and Atwater's study, plus the Wesleyan case, even led British dealers to cancel orders for Blue Points (oysters from New York City's Jamaica Bay). The USFC became involved in New York too, surveying Great Bay on Long Island. Unfortunately they did not publish the results of this work, which was partly a response to declining sales of Blue Points.¹⁴

Despite the advent of surveys and floating bans, New York City unsurprisingly continued to experience some of the worst problems associated with sewage pollution, and Jamaica Bay was the hardest hit area. Most sewers from Brooklyn and Queens

¹³ *New York Times*, January 5, 1895.

¹⁴ *New York Times*, January 25, 1895.

Counties drained into the shallow bay, and barrier islands slowed circulation with the open ocean. Jamaica Bay was environmentally ill-suited to be a sewage sink, but it was ideal for oysters, producing about half the New York City area's total. A number of serious outbreaks, including ones in 1904 and 1911, were traced to Jamaica Bay oysters. After the 1904 case, George Soper, a sanitary engineer from the State Board of Health, investigated. He attributed twenty known cases to oysters from Rockaway, on Jamaica Bay, but noted that the same crop of oysters was sold elsewhere. He estimated that these oysters may have caused hundreds, perhaps thousands, of typhoid cases. The *New York Times* quoted Soper as saying, "[i]t is only a matter of time before the waters of Jamaica Bay are excluded either the sewage or the edible shellfish."¹⁵ In 1908, the city passed a law specifying that oysters could only be sold from locations certified as sanitary, thus adopting a procedure similar to Rhode Island (see below).¹⁶

Soper also used small floating devices to study tides. Many thought tides flushed the bays and river around the New York City clean each day, but Soper showed otherwise. Soper believed oysters caused around fifteen percent of the city's typhoid cases. The same report discussed Jamaica Bay pollution.¹⁷ However, the efficacy of using the ocean to dilute sewage was a scientific debate at this time, and a Dr. Bensen, who also published on oyster sanitation, told the *New York Times* tides in the Jamaica Bay washed away germs.¹⁸ A 1911 outbreak highlighted the growing dangers from Jamaica Bay

¹⁵ *New York Times*, March 5, 1905.

¹⁶ *New York Times*, May 11, 1908.

¹⁷ *New York Times*, March 15, 1911.

¹⁸ *New York Times*, September 16, 1911.

oysters. After a fireman's diner, seventeen people fell ill, one of whom died, from eating raw oysters from Indian Creek near Canarsie, in Jamaica Bay.¹⁹

Other states also began conducting surveys and passing sanitary oyster regulations. Connecticut's State Board of Health placed restrictions on floating in 1896.²⁰ New Jersey banned oysters from Atlantic City after a typhoid outbreak was traced in oysters there in 1902.²¹ Oysters had traditionally been gathered along the shore, but Atlantic City's increasing hotel development had rendered the water dangerously unhealthy. In his review of the field, George Fuller commented that most of the more prominent growing and fattening areas in U.S. and elsewhere had been examined in sanitary surveys by 1905.²² One suspects this led to an array of local regulations similar to the ones mentioned above.

The best documented sanitary survey was Caleb Allen Fuller's survey of Narragansett Bay, Rhode Island.²³ This was Fuller's Ph.D. thesis at Brown University, and he continued in this field over the subsequent years. His work was printed in the USFC's 1904 report, and served as a guide to later studies. The purpose of Fuller's survey was to deal with obvious sewage pollution in the Narragansett River. Providence's sewers drained directly into the river, as did other towns', and unfortunately the river was also Rhode Island's largest planting area. The results of his survey showed the river to be seriously polluted with sewage. He produced a map showing a decrease in sewage concentrations away from urban areas (see figure 8.1). The state shellfish commission used his work to create three zones in Narragansett Bay. Growing or harvesting oysters in

¹⁹ Ibid.

²⁰ *New York Times*, February 14, 1896.

²¹ New Jersey Shellfish Commission. 1903. *Annual Report of the New Jersey Shellfish Commission*.

²² Fuller, 1905.

²³ Ibid.

the first was prohibited. The third category required no special action by the oysterman, but growing or fattening oysters in the second required one to obtain a permit. To do so, oysters had to be inspected. Rather than simply banning oysters from polluted areas, this was the first system of oyster sanitation certification. Surveying became more complicated when scientists discovered that oysters had much less sewage in them in the winter when they closed up, raising questions about when one could adequately sample them. Of the state oyster commissions, Rhode Island's was the most involved in sanitation, publishing its first "sanitary report" in 1906.²⁴ They began issuing sanitary certificates in 1911. 2,134 acres failed to meet the standards that year. Oysters were condemned if three out of five tested had *E. coli* in one-tenth of a cubic centimeter of shell liquor.²⁵

8.4 Packers' problem: self-regulation and consumer confidence

As the Wesleyan case showed, public fear of contaminated oysters was a threat to the entire industry. Oystermen were well aware of this, and oyster packers and planters organized to shape public opinion. The first example of this from New York came from 1897. Oyster dealers responded to public fears by hiring their own scientist from the Carnegie Institute of New York to test Blue Points. He found them to be healthy, saying sea water would kill any typhoid germs that might come into the bay, another popular theory that supported the dilution method of sewage disposal. According to the *New York Times*, the dealers and planters who hired this scientist thought their U.S. rivals started

²⁴ Rhode Island Shell Fisheries Commission. 1906. *Annual Report of the Commissioners of Shell Fisheries*. Providence also established the first municipal public health laboratory in 1888. Melosi, 2000. p.113.

²⁵ Rhode Island Shell Fisheries Commission. 1912. *Annual Report of the Commissioners of Shell Fisheries*.

rumors about their product.²⁶ This example shows the two related problems oystermen faced: they needed outside scientists to help them establish the safety of their product to consumers, and they required unanimous cooperation because it only took one person to cause a problem.

Prominent planters and packers formed the Oyster Growers and Dealers Association (OGDA) in 1908 to combat public fears of their product. The bank panic of 1907 had hurt planters' business too. Henry Rowe was the chief organizer, and the OGDA held its first meeting in New York City in 1909, a year after the National Association of Shellfish Commissioners. The two organizations both had New York headquarters, and members of each went to each other's meetings. The OGDA's chief concern was "to educate the public about the wholesomeness of oysters."²⁷ Speeches at their first meetings show disagreement with scientists on this issue. Their first president, Azel Merrill, said "there seems to be an impassable gulf between scientific conclusions and the practical knowledge of the planter."²⁸ Despite this, they invited scientists such as Moore and Nelson. They also said competitors in the food packing business were spreading rumors exaggerating the safety risks of their product. OGDA meetings drew from one hundred to over three hundred up until WWI, when attendance waned, reaching a low of thirty-six in 1919. Attendance doubled in 1925, following a typhoid outbreak. The OGDA worked with the U.S. Public Health Service on creating uniform standards for shucking, packing, and shipping oysters in 1927.

Packers also took steps to improve sanitary practices within their packing houses. Commission reports indicate that Rhode Island planters were leaders in this area. Planters

²⁶ *New York Times*, January 31, 1897.

²⁷ Carriker, 2004. p.5.

²⁸ *Ibid.* p.15.

formed a state Oyster Growers Association by 1908. This group complained to the state shellfish commission about pollution at a meeting in March, 1910. They also told the commission that they wanted standards for packing houses. The commission was already using standards and certification on the oyster beds, and the planters' association wanted this same process extended to their packing houses. To this end, the association proposed a law to regulate packing house conditions. The commission reported that they toured packing houses twice during this general period, and they found their sanitary conditions much improved. Almost all had installed steam or boiling sterilization systems. The associations' members had also come up with rules for opening oysters, and had posted these in all the packing houses. The 1911 report shows that the state passed the packing house law. It stated that packing houses had to be well-ventilated and cleaned every day. Oyster had to be opened in "proper containers," not on benches, all utensils had to be sanitized, and all employees had to wear gloves and aprons and could not work when sick. Spitting was prohibited too. The commission reported that all thirty-three houses were able to obtain permits, and they met with no objections or complaints. A leading sanitation scientist described their efforts as follows: "They have co-operated nobly in the matter and have helped to bring about a complete revolution in their business, which has in many cases involved changes in methods which were as old as the industry itself."²⁹ This case shows how the associations' members were self-regulating sanitary conditions, and how they wanted the state commission to turn their system into law. They wanted the state to help with enforcement (to ensure total compliance) and to give their product a more objective certification that could boost consumer confidence.

²⁹ Gorham, Frederic P. 1912. The sanitary regulation of the oyster industry. *American Journal of Public Health* 2: 77-85.

Many packers were also planters, and planters saw the same need to ensure a safe product. Port Norris, New Jersey planters provide an example of how they did this. Port Norris was a small town on lower Delaware Bay in the heart of the Bay's planting region. These planters had lesser problems than in New York, but sewage entered planting grounds from the ships working the beds and from the nearby port. Planters, who had a local association and who had previously cooperated in hiring watchmen, set up a system of latrines along the port and a sanitary patrol boat that would empty sewage pails from the boats.³⁰

8.5 Quantifying acceptable risk: the search for a uniform standard

During the early 1900s, scientists worked on a scoring system to aid surveyors and regulators. This was a standard system that awarded points based on contamination level and sample size. The points could then be translated into a rough estimation of health risk. Surveyors would check oysters for *E. coli* concentrations, and if they fell above a certain line, then they would ban sales. The difficulty was establishing exactly where this line should be. This required determining acceptable risk levels. Several such measures developed in the 1900s; indeed every health inspector who banned sales of floating used such as system implicitly or explicitly.

The American Public Health Association (APHA) Committee on Standard Methods made an effort, beginning in 1910, to standardize the data collection and scoring process. They began by trying consolidate and unify the data collection and analysis procedures, and they stopped short of recommending the level of contamination that should lead to regulation, saying “[t]he work of the committee has been confined

³⁰ Carmichael, Mary Cornish. 1984. *Oh boy! Roy joy!* New York: Vintage Press.

exclusively to the scientific aspects of the problem.”³¹ The APHA committee wrote that they recognized the political nature of such regulations, stating that “[t]he committee does not feel called upon to establish at the present time any standards of purity for oysters or other shellfish. This is a matter to be determined by the various administrative authorities interested in the subject.”³² Their work led to the APHA’s first edition of 1st edition of *Recommended Procedures for the Examination of Sea Water and Shellfish* in 1922. This edition did standardize collection and analysis methods for awarding points, but they failed to reach a consensus on a level of acceptable risk.³³

In late 1924, a typhoid outbreak attributed solely to oysters sickened at least 1,500 and killed 150. The oysters most likely came from Raritan Bay, of New York and New Jersey border. The outbreak affected Chicago, Washington, New York City and other locations. Illinois banned eating uncooked shellfish as a result. Oyster sales plummeted. It was however, only a slight increase in overall typhoid cases that year above the national average, and the average dropped steadily during the twentieth century. Nonetheless, Baltimore dealers declared that five thousand were out of work in the city due to closed packing houses.³⁴

Government scientists responded to the outbreak. The Surgeon General sponsored a national conference in Washington on February 19, 1925, inviting city and state health authorities, members of state conservation commissions and the USFC, the U.S. Public Health Service (USPHS), and the shellfish industry. Attendees recommended that beds,

³¹ Whipple, George C., A. W. Freeman, Stephen De M. Gage, William Royal Stokes, H. D. Pease 1911. Second progress report of the Committee on Standard Methods of Shellfish Examination. *American Journal of Public Health*. p.36.

³² Ibid.

³³ American Public Health Association. 1922. *Recommended procedures for the examination of sea water and shellfish*.

³⁴ *New York Times*, January 25, 1925.

packing houses, and shipping facilities should be inspected by state or USPHS officials. The other key point was that “[t]he product must conform to an established bacterial standard.”³⁵ In other words, they recommended a more thorough and unified version of what already existed, and they called for a national contamination level standard. However the attendees, like the APHA, did not reach a consensus on what the “established bacterial standard” should be.

Scientists would eventually set a uniform national standard, but this was a slow process. The USPHS 1925 report of the Committee on the Sanitary Control of the Shellfish Industry defined oysters as safe if *E. coli* was absent from “the majority of 1 ml volumes.”³⁶ By 1939, the APHA settled on a standard that said oysters should be condemned if 50% of 1 ml volumes contained *E. coli*.³⁷ This measure, which is still in use today, was derived from scientists’ experience and debate. It is now used to ban oysters due to *E. coli* contamination and not typhoid.

8.6 The USDA’s floating ban

In 1909 the USDA banned the practice of floating oysters. This was done for partly sanitary reasons, as oysters often came into contact with sewage in places where they were floated. Floating was also banned as an “adulteration” under the Pure Food and Drug Act, meaning the USDA thought it was done simply to fatten meager oysters and make sick ones look healthy, thus defrauding consumers. While there was doubtless some truth to this, floating also stored oysters near markets, cleaned sediment from them, and

³⁵ Conference of Shellfish Pollution. 1925. *Report of the Committee of sanitary control of the shellfish industry in the United States*. Washington, D.C.: Government Printing Office.

³⁶ *Ibid*, p.xx.

³⁷ American Public Health Association. 1939. *Recommended procedures for the examination of sea water and shellfish*.

improved flavor and texture in many people's opinions. It had long been integral to the fishery. An article in the *Oysterman and Fisherman* titled "To Be or Not To Be?" called the ruling "the greatest blow the culturist has ever received."³⁸ The head of New Jersey's Shellfish Commission, Charles Bacon, complained that the commissions were not warned about the impending ruling, saying "We were accused, indicted, tried and convicted without a hearing."³⁹ Other articles said it would ruin the fishery.

A group of oystermen and scientist went to Washington shortly after this to plead their case. The most important testimony came from Julius Nelson. His talk covered all aspects of floating, and it went over every possible objection to it, refuting each one with the latest scientific evidence, while also showing an impressive knowledge of industry practices. It showed that floating led to healthy and desirable improvement in oysters. Of course, the issue at hand was not pollution alone, and Nelson was not arguing that floating near sewers was safe. The strength of Nelson's testimony convinced Dr. Wiley, the USDA official who created the ruling, and led him to lift the ban at the end of the meeting.⁴⁰

8.7 Discussion: making safety visible

Packing house sanitation helped solve packers' collective action problem (the need for sanitary conditions). Even one non-compliant packer could ruin everyone's reputation and business. Rhode Island packers were able to solve this problem themselves, but this would have been much harder on a national scale without state intervention. In this way, we can see state knowledge production and police power as

³⁸ *Oysterman and Fisherman* 7 (7): 1910.

³⁹ Ibid.

⁴⁰ *Oysterman and Fisherman* 7 (9): 1910.

being used at the request of packers. Evidence from Rhode Island and the OGDAs bears this out. Leadership among the packers and their associations was important to this process too, as were crises that stimulated action. But packers wanted state intervention for another reason. The state could use its position as employing “disinterested” scientists, who used the latest peer reviewed methods, to certify the healthiness of their product. This would make safety visible to consumers. In doing so, scientists were part of a larger, on-going effort at product certification designed to protect consumers.

Scientists increased the visibility of bacteria and safety by creating a simplified scientific statistical picture of nature. They rapidly acquired great skill at this. However, no matter how precise and refined their new knowledge, they could not use it to quantify safety, as there was no objective way of determining how much *B. coli* actually lead to a person catching typhoid. Such uncertainty remains a major problem with using pollution thresholds in environmental regulation to this day.⁴¹ Thus there was a social construction of nature that claimed to be objective, and the scientists and oystermen wanted it to be, but which was inherently political. Scientists recognized this as their first attempts at unification only covered methods, but they were soon asked to take on the role of setting standards. They made rapid progress understanding oyster bacteriology. It only took about a decade from the Wesleyan outbreak to Fuller’s review of the field, and in this time scientists learned enough to conduct accurate sanitary certifications that could support regulation and certification. The search for a unified standard last much longer and only coalesced around 1939. It took longer because there was no scientific way to

⁴¹ Thorton, Joe. 2000. *Pandora's poison: Chlorine, health, and a new environmental strategy*. Cambridge: MIT Press.

decide on a threshold and one took shape through traditional use, and it took decades to establish a tradition.

Despite the inherent scientific weakness of the threshold concept, certification had strengths too. It helped consumers see safety. It was a necessary response to scale. Populous, complex societies, where numerous interactions take place through market exchange, need a way for people, in their role as consumers, to make decisions about the quality of the products they buy. Certification provides a way to do that, as do pollution regulations more broadly. It replaced more personal interaction that happened before the Progressive Era, when there was less invisible pollution to worry about, and when purchasing was more local and personal. Certification needed to be controlled by democratic procedures though, and corporations have historically tried to co-opt certifying agencies. Scientific agencies were set up to be a bulwark of integrity, in part to prevent this type of abuse, but science can be silenced and corporations can use the prestige of science too, by controlling its funding or agency appointments.⁴²

⁴² Markowitz, Gerald and Rosner, David. 2002. *Deceit and denial: The deadly politics of industrial pollution*. Berkeley: University of California Press.

Chapter nine: conclusion

9.1 Summary of the theoretical perspective

Environmental historians and historical geographers have recently been reappraising Progressive Era conservation, and this dissertation contributes to this effort by examining the interaction between local resource users (oystermen) and state knowledge production in the new conservation agencies. The main finding is that the state's new knowledge bureaucratized traditional practices and norms. These practices and norms were conservation measures on the one hand, and goals and ethics underlying them on the other. They were developed by oystermen during the nineteenth century. These practices were sensible ways to protect the resource, even if they were not always successful. Early oyster management was not only directed at conservation. It was also designed to ensure equity and maintain or limit access. Since oyster management featured common property side by side with the expansion of semi-private planting property, early management had both communitarian and liberal strains. Judd and others have noted that rural people began protecting natural resources before the Progressive Era government agencies started doing this, and this dissertation adds to our understanding of this process by examining the role of knowledge production in this transition.

In this shift to state management of oysters, the new agencies produced five kinds of knowledge: surveillance knowledge, legislative advisory reports, natural science, cartographic property maps, and sanitation/disease knowledge. The major goal of the dissertation has been to reconstruct the process, content, and reception of the knowledge, thus creating a human geography of knowledge. To interpret these activities, I have described the institutional and cultural context of the new agencies. These are the most

important of Hull's enabling conditions that help us understand why people chose to create and utilize the kind of knowledge they did.

This study draws on the science studies idea of co-production, where science and the social order produce and reinforce one another. Not all knowledge production in the new state agencies was strictly scientific, but the co-production model fits these other forms well too. The predominate view of social order in this case, and in the Progressive conservation more generally, was the "gospel of efficiency," which equated increased efficiency with the public good. However, there was also an alternative way of thinking about the social order and knowledge production, one that relied on traditional norms and practices to link resource use and the public good. I have referred to these divergent views as the two gospels of efficiency, calling one "high modernist" and the other "populist," because both were utilitarian.

To understand the significance of these two strains in Progressive conservation, this study engages the literature on governmentality by historical geographers. These scholars have shown how state actors used knowledge production to make people and resources visible for more efficient management, and what distinguishes governmentality is the way they then tried to use this knowledge to adjust society and resource use so that it was more self-governing. To make this happen, society had to follow social laws, and it is this nexus of picturing society/resources and guiding behavior toward supposed social laws that defines the governmentality process. This theory fits the high modernist Progressives exactly. However, it does not fit the populists, and the difference was that the populists based their prescriptions on traditional norms and practices, instead of on universal social laws.

9.2 Summary of state management practices and knowledge production

9.2.1 Surveillance

Section 9.2 briefly describes the creation, content, and reception of each of the five kinds of knowledge. Within each, one can see the “two gospels” in varying degrees. Surveillance knowledge was the licensing of oystermen and the registration of vessels, both of which made the fishery and fishermen visible to the state, especially law enforcement officers. This type of knowledge was also important for taxation and legislation. In general, it was used to enforce older laws like residency rules or gear and vessel restrictions. It was perhaps most important in the Chesapeake Bay oyster navies’ long running battle to stop illegal dredging sponsored by wealthy packers and planters. Although tongers welcomed the exclusion of illegal dredgers, they were often ambivalent towards increased law enforcement. In aftermath of the “Riggin affair,” Virginia tongers were pleased to see Marylanders excluded from their waters, whereas Maryland tongers were happy to lose access. Even though more consistent enforcement displeased these Maryland tongers, the oyster navies were enforcing traditional residency requirements. Increased surveillance knowledge was a necessary part of the state’s slow state control over violence, which in general led to better enforcement of traditional rules. It was an important way the state bureaucratized tradition.

9.2.2 Legislative advisory reports

The state commissions regularly wrote reports to the legislature, and one of their chief duties was to make the fishery visible to legislators. The legislators used these

reports to write laws. Much of the time, the commissioners would voice their own opinions about how oysters laws, sometimes going so far as to include bills in their reports.

Many reports were staunchly high modernists, and a smaller number were populist, with some falling in between or combining these perspectives in odd ways. Both groups saw that laws needed reform. The laws had grown so numerous that they were contradictory and confused oystermen. Both groups also agreed that there was a great deal of conflict and over-harvesting, although the severity of these problems differed with location. The two groups disagreed, however, on how to proceed. High modernist commissioners wanted to expand planting and reduce tonging, thereby radical recasting the fishery. To that end, they called for sweeping changes in the laws, especially those regarding property. They used the fishery data in their reports to argue that expanded planting was the only logical solution to conflict and over-harvesting. Populist commissioners argued that radically change would do more harm than good, and they instead wanted a more rational, orderly version of pre-existing management. They wanted to reform the laws in a way that preserved their spirit, which required streamlining them and improving enforcement. Like the high modernists, they used the picture of the fishery in their reports to convince legislators. Overall the populists' were more successful in carrying out their reform program. Legislatures responsive to rural majorities, and oystermen were numerous, and courts were sympathetic too, which helps explain the success of the "populist" program..

9.2.3 Natural science

The first generation of oyster scientists produced natural history knowledge to make natural processes visible for the first time, and to use this knowledge to improve the fishery. Early natural science focused mainly on oyster reproductive biology and applied this a program of artificial cultivation. It followed a larger emphasis of fish culture in federal and state commissions at this time. Despite fervent effort, this program failed due to the difficulty of rearing oysters in hatchery or laboratory conditions. Oyster scientists were mainly high modernists, and their lack of success stymied the high modernist reforms more generally.

9.2.4 Cartography

Cartographers produced maps showing the location of oystermen's property and the natural beds (which were synonymous for tongers). They made oyster biogeography and property visible to the state. They used their new tools and techniques to rationalize pre-existing property rights. Cartography was very important to commissions and often among the first work they performed. Both high modernists and populists wanted to rationalize property, but high modernists wanted to use mapping to limit tonging by showing that tongers claimed much empty and unproductive space. Virginia's two mapping projects, the Baylor and Moore surveys, as well as Yates' Maryland survey, tried to do this and failed. Even when the cartographers were high modernists, rural people were able to affect either the content or use of the maps. The result was that oyster mapping bureaucratized traditional property rights.

9.2.5 Sanitation

The last form of knowledge the agencies produced was sanitation. Scientists produced knowledge about the bacteriology of typhoid in oysters and disease concentrations in the bays. These activities made disease visible to state, and to the interested public. Sanitation science had the least precedent in traditional management, as there was no pre-1880 oyster sanitation measures and pre-1880 urban sanitation relied on the dilution method. It thus stands as an important exception to the overall pattern. There were two branches to this science: one studied bacteriology and quickly solved the major scientific problems, while the other measured bacteria concentrations to determine health threats in bays and in packing houses. Establishing thresholds of acceptable risk was an inherently political activity and it took decades for scientists to arrive at a consensus. In a sense, these scientists were high modernist too, because they sought an a-political, quantitative measure for a political question. Despite this their knowledge led to sanitary certifications, something wholly new, and these helped the consumers see the environmental condition of the oysters they purchased.

9.3 Summary of the institutional and cultural context

The larger institutional context is the creation of the first government natural resource management agencies at this time, and to a lesser extent, the advent of research universities. Abbott describes how professions seek legitimacy by offering definitions of problems and expertise-based solutions to relevant audiences, and the precarious funding situation of the early agencies meant they had to do this to establish a rationale for resource management professionals. Porter shows that weak legitimacy leads government agencies to rely on quantitative measures to argue for their desired course of action. The

new oyster agencies, and much Progressive Era government resource management, fit this pattern of weak legitimacy and the result was an emphasis on the quantitative goals of increasing production and increasing efficiency. For high modernists, these were their rationale. The fishery (or forest, or farm) was inefficient, so experts would study it and apply new knowledge to make it more efficient and productive. This logic was attractive because it seemed unassailable (who would not want increased productivity?), progress seemed measurable or demonstrable, and it made use of the new professionals knowledge production expertise. These factors help account for the widespread appeal of efficiency planning in this time period.

The Progressive Era natural resource managers could have advocated for less narrowly quantitative goals. Agrarian populists wanted land reform and access to credit and markets, for instance, not just new technologies or breeds that could increase production. This pattern of avoiding political issues and focusing instead on increasing production through efficiency was common to the new agricultural extension service, the U.S. Forest Service, and the USFC. It was true of the new research universities as well. Only Johns Hopkins and Rutgers Universities enter this dissertation, but they both follow this pattern. Brooks was the country's leading morphologist and the model research university, and he tried to produce morphological knowledge that would increase productivity through artificial cultivation.

Increasing production meant using the fruit of new research, and wealthier segments were always better positioned to invest in these, hence the research tended to benefit the wealthier more directly, be they farmers or fishermen. The agencies' need to form political alliance augmented this pattern. Termed "associate-state building," agency

personnel formed partnerships with resource users who could benefit from the innovations the agencies produced. This was especially true for the agricultural extension service. For oysters, the close partnership between National Association of Shellfish Commissioners and the Oyster Growers and Dealers Association was a good example of this. The USFC also had close ties with the American Fish Culturists Association, especially after Baird's death. Fish and oyster culture were ways experts could increase productivity and thus legitimize their professional activities. The result of institutional pressures in this context led to a narrowly numeric goal of maximizing production that could be achieved with professional's new expertise at knowledge production. It was an institutional context that encouraged high modernism.

But institutions were only part of the story. The cultural context shaped the way high modernists thought about efficiency. The most important context were two broad discourses associated with technology and property. This time period was an era of evolutionism or teleological thinking. Many people saw technology as advancing through specific stages toward more industrial forms. High modernists applied this to the oyster fishery, viewing tongers seen as anachronistic and planters as progressive. Property seen as evolving the same way, advancing from common to private property. These "stages of growth" formulas reinforced one another because tongers used common property and planters more privatized forms, and the combined narrative was ubiquitous among high modernists in the oyster fishery. The narrative called for professional expertise and knowledge production in new agencies that strove to increase production by expanding planting and privatization. These goals fit neatly into the associative state alliances.

The institutional and cultural contexts of high modernism reinforced each other so seamlessly that it is surprising rural people and populist commissioners were able to bend knowledge production to a different aim. Keiner has shown that in Maryland the legislature was sympathetic to tongs due to their voting power.¹ Sanders has shown that rural majorities heavily influenced Progressive Era reforms, and this seems to have been the pattern for oysters.² In addition, much of the important knowledge the new oyster agencies produced had a different political base and aims than the associative state, production maximizing model. Surveillance had a broad base of support among oystermen, and it could help old system just as much as new. It was not really designed to maximize production. Legislative advising could and did support high modernist or populist proposals. The temporary advising commissions did not try to justify continued funding or professional expertise, and the advice from permanent commissions was never the sole reason for their existence. Natural science fit the high modernist pattern best because its support was tied most directly to proving the usefulness of a new professional approach. Cartography was new, but there was broad support for rationalizing property rights. The cultural context supporting the populist commissioners was a tradition that mixed communitarian and liberal values, and that grew out of the U.S. encounter with the frontier. The literature on institutional and cultural context of Progressive high modernism is well-developed, and this dissertation contributes to this by exploring a case where high modernism met conditions favorable for the maintenance of traditional norms and practices.

¹ Keiner, 2001.

² Sanders, 1999.

9.4 Rationalism

Finally, the two versions of utilitarian Progressivism are examples of what Weber calls formal and substantive rationality.³ An action is formally rational when it follows a rational technique (i.e., it is efficient), and an action is substantively rational when it follows an ethical guide of some sort. High modern oyster commissioners called for a course of action that formally rational, but substantively irrational. Weber notes that formal rationality tends to increase at the expense of substantive rationality, and that was the high modernists' aim. This dissertation provides a case study that demonstrates some reason why this happens.

Princen explains why the formally rational goal of efficiency is substantively irrational.⁴ He notes that one can efficiently do anything, so increasing efficiency only avoids the question of which goals one should follow. Maximizing production also avoids the key ethical questions of who gets to own and produce this new bounty. Princen notes that efficiency is actually a means masquerading as an end, a technique substituted for an ethical guide. Much Progressive Era efficiency planning, especially the work of Taylor's Scientific Management movement, fell into this pattern of using efficiency experts to depoliticize political issues. High modernist oyster commissioners fit this pattern, as did fish hatcheries in general.

Princen describes the appeal and spread of formal rationality and high modernism in the Progressive Era, and this dissertation shows the same thing at a more micro-historical level. The value of this smaller scale is that it suggests some of the enabling conditions of the spread of formal rationality and efficiency outside of its purview. Oyster commissioners

³ Weber, 1977.

⁴ Princen, 2005.

felt a sense of crisis, and they faced institutional pressure to respond with immediately applicable measures that led to quantifiable success. This combined with the presence of colonial ideas about property and technology that denigrated local people's potential contributions to a solution. The situation encouraged intervention by people with technological optimism and faith in social laws. On the other hand, this study also suggests some conditions leading to the maintenance or substantive rationality. The populist commissioners had a sense of respect for past practices and the knowledge of local people. They saw these as essential components of any solution. Institutional pressure for narrowly quantifiable results was less due to broader support. These commissioners had less faith in social laws and less technological optimism.

Nussbaum identifies the same tension between these two rival version of the public good in Greek tragedy.⁵ The antiquity of this debate suggests that it is unavoidable. Perhaps the real tragedy in the tragedy of the commons is not an inexorable social law dooming fishermen to ruin, but rather our stubborn insistence on replacing traditional ethics with social laws as a guide to the public good. If there is a failure, a weakness, in human nature in this tragedy, it not our selfishness, it is our need for certainty.

⁵ Nussbaum, Martha. 1986. *The fragility of goodness: Luck and ethics in Greek tragedy and philosophy*. Cambridge: Cambridge University Press.

Illustrations

Figure 2.1: Oyster tongs (Ingersoll, 1882)

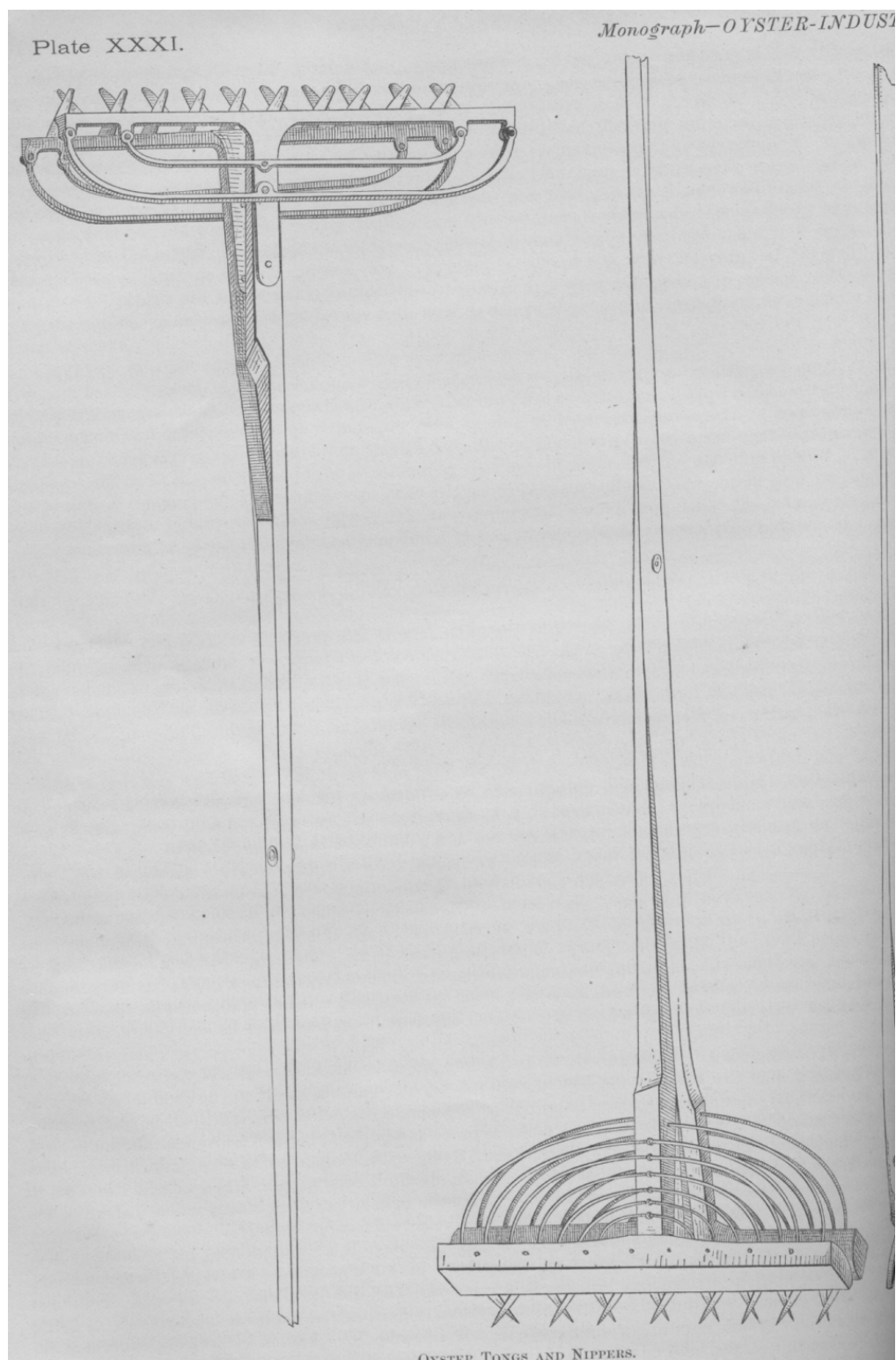


Figure 2.2: Tongers in Prince's Bay, Staten Island, New York (*Illustrated News*, 1852)

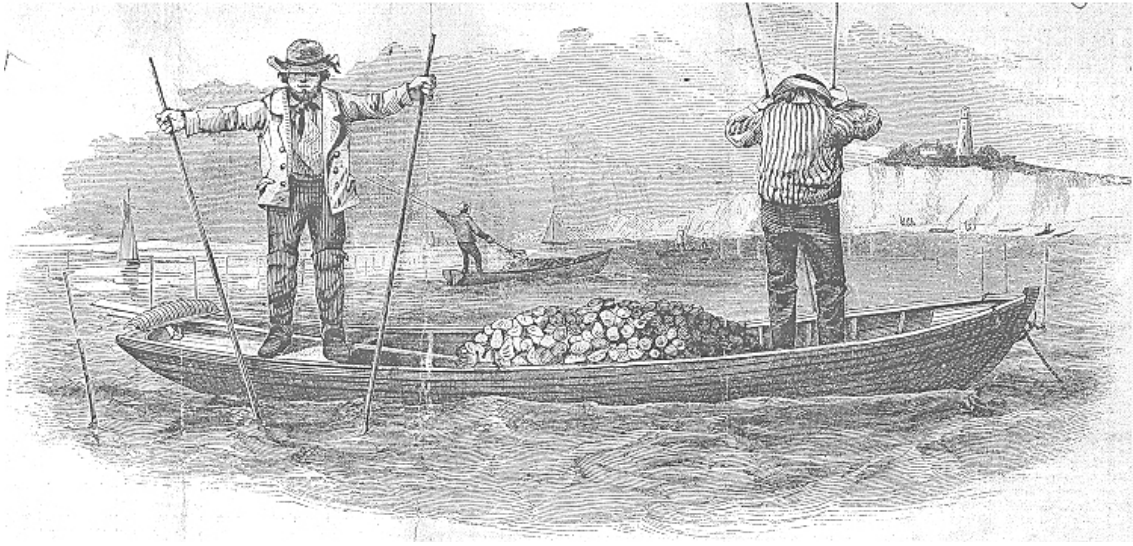


Figure 2.3: Oyster dredge (Ingersoll, 1882)

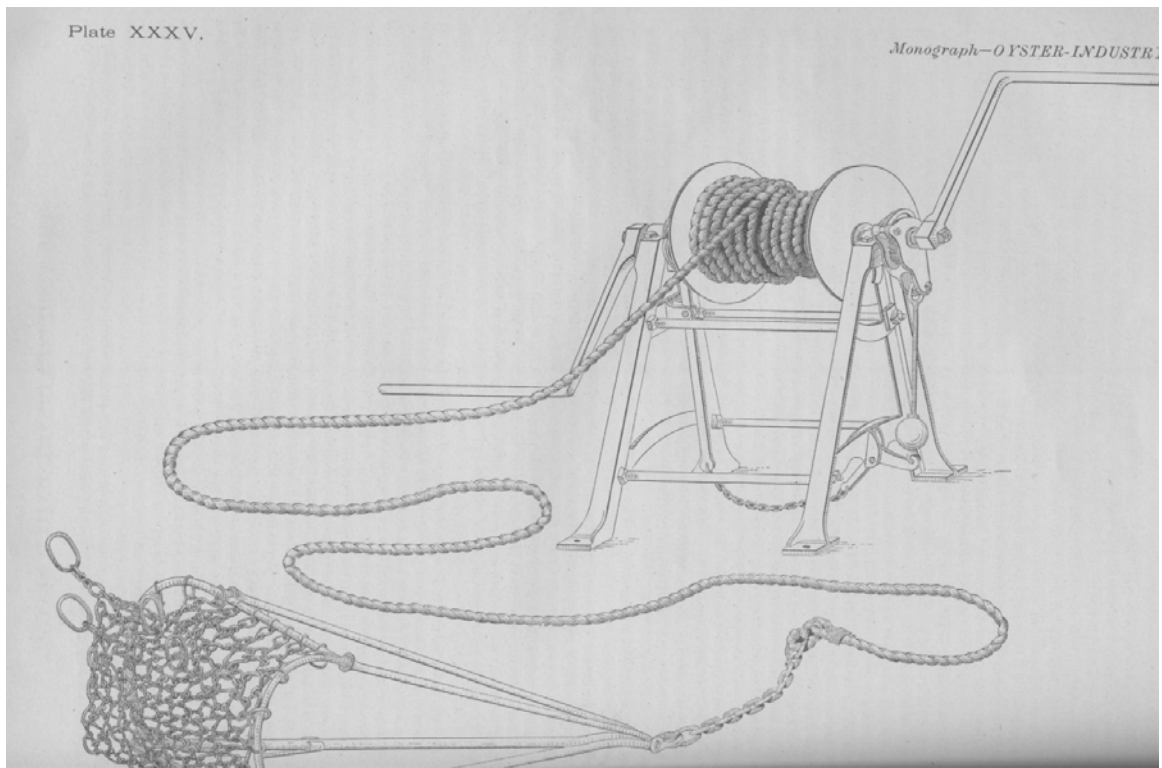


Figure 2.4: Planting boat (New Jersey Shellfish Commission Report, 1907)



Figure 4.1: Large planting steamer, the *Henry C. Rowe* (Kochkiss, 1974)

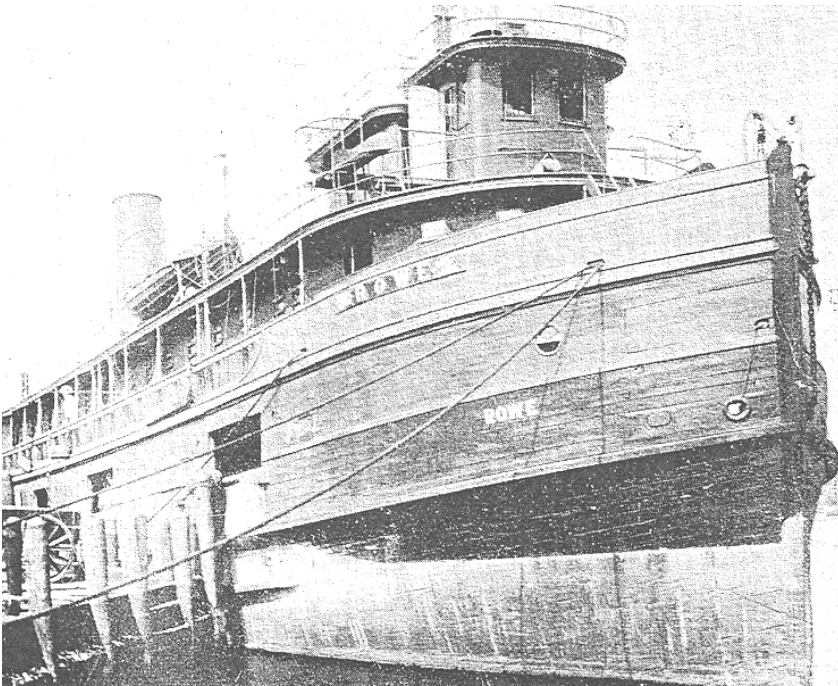


Figure 5.1: Lake Fusaro, from Coste's report (Report of the USFC, 1878)

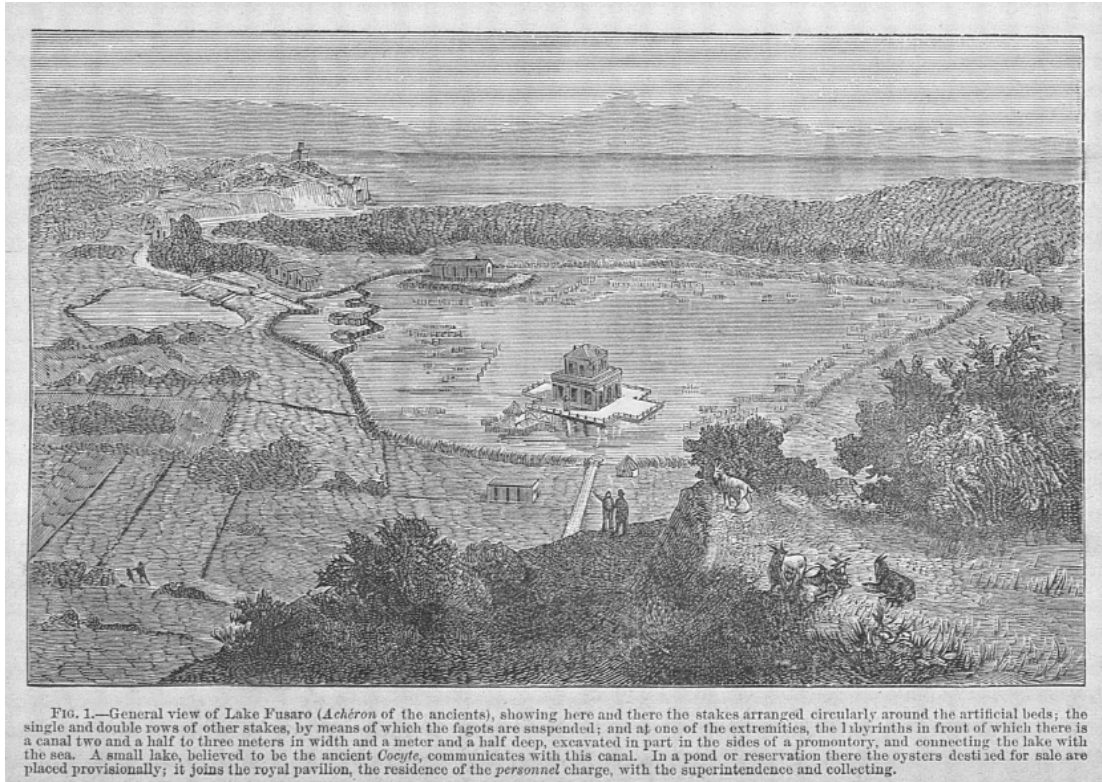


Figure 5.2: Rutgers University's shellfish laboratory, the houseboat *Cynthia* (Kochkiss, 1974)



Figure 6.1: Connecticut lease map (Connecticut Shell Fish Commission. 1924. *Annual Report of the State Shell Fish Commission.*)



Figure 7.1: Half of H. F. Moore's James River resurvey map (Report of the USFC, 1910)

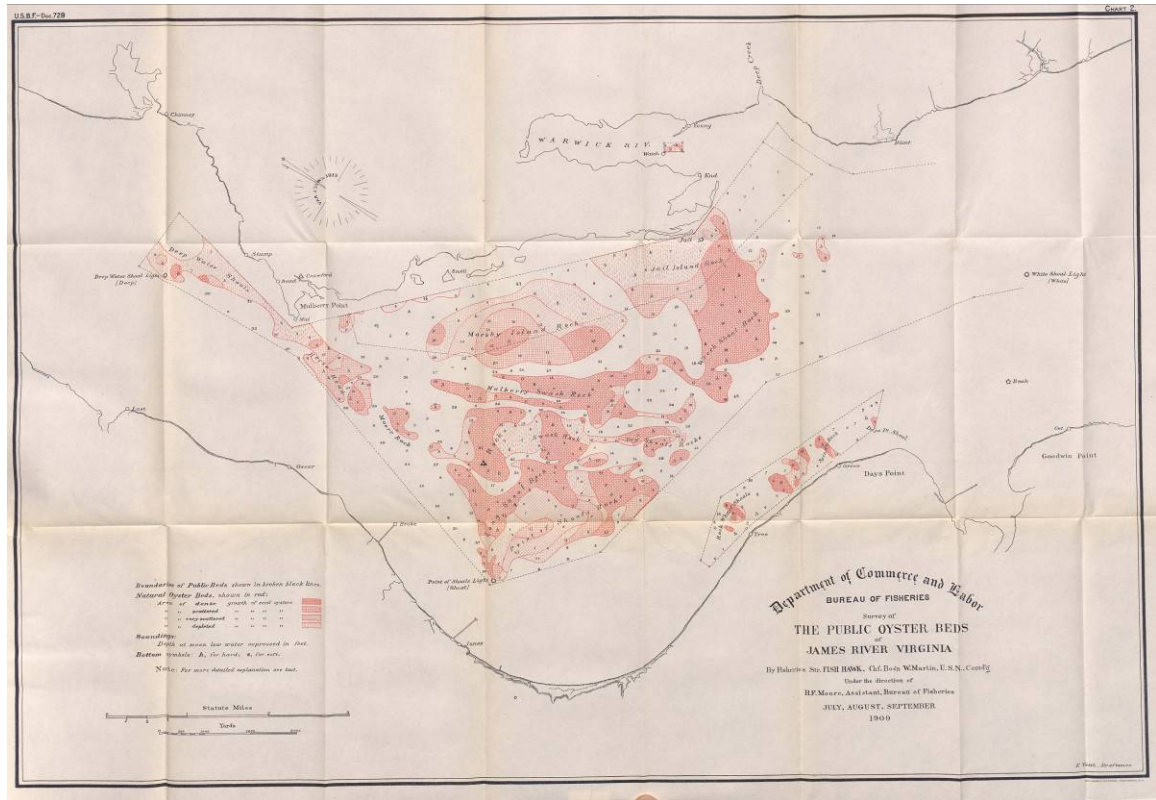


Figure 7.2: Detail of Moore's map showing oysters and Baylor lines (Report of the USFC, 1910)

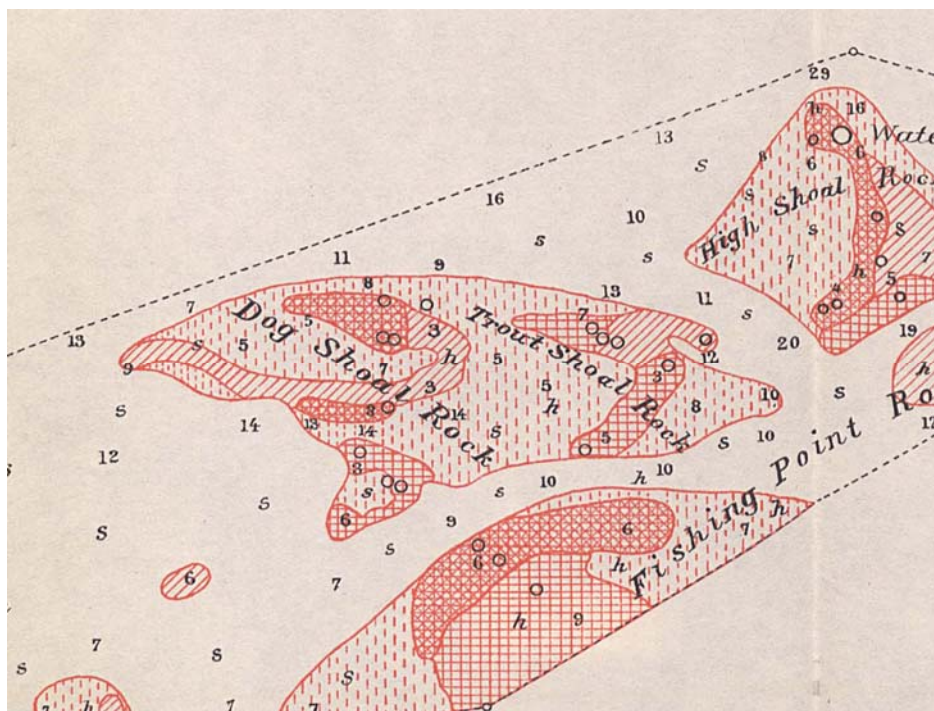
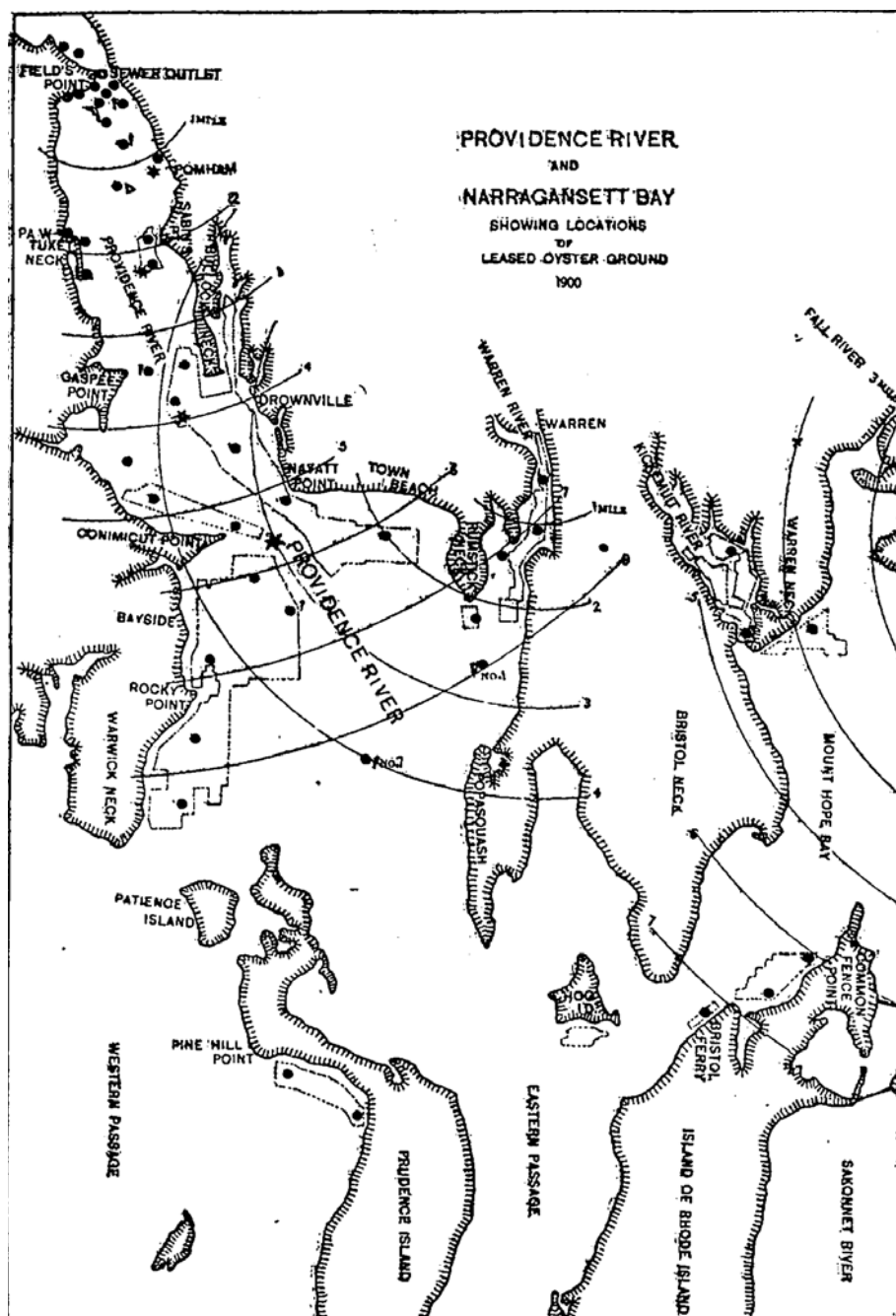


Figure 8.1: Fuller's Narragansett Bay sewage map, the first U.S. oyster sanitation map (Report of the USFC, 1906)



Works Cited

Primary sources locations

Commission reports

U.S. Fish Commission Reports and Bulletins: Rutgers University and on-line
 Massachusetts reports: Princeton University, Princeton, NJ
 Rhode Island reports: University of Rhode Island Special Collections, East Kingston, RI
 Connecticut reports: Connecticut State Library, Hartford, CT
 New York reports: New York Public Library, New York, NY
 New Jersey reports: New Jersey State Library, Trenton, NJ and Rutgers University
 Special Collections
 Maryland reports: Maryland State Archives, Annapolis, MD
 Virginia reports: University of Virginia, Charlottesville, VA.

Correspondences and papers

U.S. Fish Commission collection: National Archives, Record group 22, College Park,
 MD
 University of Rhode Island Special Collections, East Kingston, RI
 Rutgers University Special Collections, New Brunswick, NJ
 University of Maryland Special Collections, College Park, MD
 Maryland State Library, Maryland State Papers. Scharf Collection MSA S1005,
 Annapolis, MD
 University of Virginia Special Collections, Charlottesville, VA
 Virginia Historical Society, Richmond, VA

Trade publications

Fishing Gazette: Library of Congress, Washington, DC
 Oysterman and Fishermen: New York Public Library

Newspapers and magazines

The New Jersey Courier, Ocean County, NJ: Rutgers University
 Peninsula Intelligence, Accomac County, VA: Library of Virginia
 Baltimore Sun, Baltimore, MD: on-line and University of Maryland
 Brooklyn Daily Eagle, New York City, NY: on-line
 Forest and Stream: Rutgers University Library and on-line

Laws and petitions

Laws: state libraries
 Petitions: Library of Virginia

Museum and other collections

Mystic Seaport Museum, Oystering Collection, Mystic, CT
 Staten Island Historical Society, New York, NY

Selected primary sources cited in the text

Anonymous. 1870. *Report of the chief inspector of oysters of Virginia to the Auditor of Public Accounts*. Norfolk: Chas. W. Wilson & Co.

- Anonymous. 1887. *Report upon the Station at St. Jerome's, Md., by the Committee of Inquiry, U S. Commission of Fish and Fisheries. Submitted Dec. 24th 1887.* Unpublished document in the USFC Collection, record group No. 22, National Archives.
- American Public Health Association. 1910. Second progress report of the Committee on Standard Methods of Shellfish Examination. *American Journal of Public Health.*
- American Public Health Association. 1922. *Recommended procedures for the examination of sea water and shellfish.* First edition. New York.
- American Public Health Association. 1939. *Recommended procedures for the examination of sea water and shellfish.* Second edition. New York.
- Anonymous. 1874. *Correspondence of the governor of Virginia with the governor of Maryland and the authorities of Accomac County, Va.* Richmond: R. F. Walker.
- Armstrong, W. N. 1879. *Notes on the oyster industry of Virginia.* Hampton: W. N. Armstrong.
- Battle, John D. 1890. An investigation of the coast waters of South Carolina with reference to oyster culture. In *Bulletin of the United States Fish Commission, No. 10.* Washington, D.C.: Government Printing Office.
- Baylor, James B. 1895. *Survey of the oyster grounds of Virginia: Report of J. B. Baylor to the Governor of Virginia.* Richmond: J. H. O'Bannon.
- Belding, David. 1909. *A report on the mollusk fisheries of Massachusetts.* Boston: Wright and Potter.
- Blackford, Eugene. 1885. Report of the work in an oyster investigation with the steamer lookout. In *Report of the Commissioner of the United States Fish Commission.* Washington, D.C.: Government Printing Office.
- Blackford, Eugene. 1885. *Report of the commissioner of fisheries of the state of New York, in charge of the oyster investigations.* Albany.
- Blackford, Eugene. 1886. Second report of the oyster investigations and survey of the oyster territories: 1885-1886. In *New York State Fisheries Commission Second Annual Report.* Albany: Argues Co. Printers.
- Blackford, Eugene. 1893. The propagation and natural history of the American Oyster: experiments at Cold Springs Harbor, L. I., by the New York State Fish Commission. *Fishing Gazette*, January 5.
- Brooks, William K. 1879. Abstract of observations upon the artificial fertilization of oyster eggs, and on the embryology of the American Oyster. *American Journal of Science.*
- Brooks, William K. 1884. *Chesapeake Zoological Laboratory: Report of the Director for its first six years, 1878-1883.* Baltimore: Johns Hopkins University.
- Brooks, William K., William Henry Legg, and James I. Waddell. 1884. *Report of the Oyster Commission of the State of Maryland.* Annapolis: James Young, State Printer.
- Brooks, William K. 1891. *The oyster: A popular summary of a scientific study.* Baltimore: Johns Hopkins Press.
- Charter of Rhode Island and Providence Plantations, July 15, 1663. Retrieved February 2, 2007 from The Avalon Project at Yale Law School at <http://www.yale.edu/lawweb/avalon/states/statech.htm>.

- Collins, J.W. 1892. Statistical review of the coast fisheries of the United States. In *Report of the Commissioner of Fish and Fisheries for the year 1888*. Washington, D.C.: Government Printing Office.
- Collins, Joseph. 1893. Opening of the oyster season. *Fishing Gazette*, January 5.
- Conference of Shellfish Pollution. 1925. *Report of the committee of sanitary control of the shellfish industry in the United States*. Washington, D.C.: Government Printing Office.
- Coste, Jean Victor. 1851. Voyage d'exploration sur le littoral de la France et de l'Italie. Translated in USFC. 1883. *Report of the Commissioner, 1880*. Washington, D.C.: Government Printing Office.
- Cowen, John K. 1889. *The Maryland oyster and his political enemies*. Baltimore.
- Davidson, Hunter. 1870. *Report of the oyster resources of Maryland to the General Assembly*. Annapolis: W. Thompson.
- De Bon, M. 1875. Report to rear-admiral the Marquis of Montaignac, Minister of Marine and the Colonies. Translated in USFC. 1883. *Report of the Commissioner for 1880*. Washington, D.C.: Government Printing Office.
- De Broca, P. 1863. On the oyster industry of the United States. In USFC. 1878. *Report of the Commissioner of the United States Fish Commission*. Washington, D.C.: Government Printing Office.
- Dean, Bashford. 1891. Report on the European methods of oyster culture. In *Bulletin of the United States Fish Commission*. Washington, D.C.: Government Printing Office.
- Dean, Bashford. 1902. Japanese oyster culture. In *Bulletin of the United States Fish Commission*. Washington, D.C.: Government Printing Office.
- Drake, J. C. 1890. On the sounds and estuaries of Georgia, with reference to oyster culture. In *United States Coast and Geodetic Survey, Bulletin No. 19*. Washington, D.C.: Government Printing Office.
- Ellyson, Taylor J. 1894. *Proceedings of the convention called to consider and discuss the oyster question*. Richmond: J. F. Ferguson and Sons.
- Ferguson. 1881. *Report of T. B. Ferguson, a Commissioner of Fisheries of Maryland*. Hagerstown: Bell.
- Fuller, Caleb Allen. 1905. The distribution of sewage in the waters of Narragansett Bay, with especial reference to the contamination of the oyster beds. In *Report of the Commissioner of Fish and Fisheries for the year 1904*. Washington, D.C.: Government Printing Office.
- Gage, Stephen. 1910. Methods of testing shellfish for pollution. *Science* 2 (31): 548-549.
- Goode, George Brown. 1884-1887. *The fisheries and fishery industries of the United States*. Washington, D.C.: Government Printing Office.
- Gorham, Frederic P. 1912. The sanitary regulation of the oyster industry. *American Journal of Public Health* 2: 77-85.
- Grave, Caswell. 1905. Investigations for the promotion of the oyster industry of North Carolina. In *Report of the Commissioner of Fish and Fisheries for the year 1903*. Washington, D.C.: Government Printing Office.
- Grave, Caswell. 1909. How to save Maryland's oyster industry. *Oystermen and Fishermen* Vol. 6, No. 10.

- Grave, Caswell. 1912. The history of oyster production in Maryland, 1810-1912. In *Fourth Report of the Oyster Commission of the State of Maryland*. Annapolis: James Young, State Printer..
- Hall, Ansley. 1894. Oyster industries of New Jersey. In *Report of the U.S. Commissioner of Fish and Fisheries for 1892*. Washington, D.C.: Government Printing Office.
- Harrison, Allen. 1896. A biographical sketch of John Adam Ryder. *Proceedings of the Academy of Natural Sciences of Philadelphia*. Philadelphia: University of Pennsylvania.
- Huxley, Thomas. 1883. Oysters and the oyster question. *English Illustrated Magazine* (1883- 84): 47-55.
- Ingersoll, Ernst. 1882. *The history and present condition of the oyster industry*. Washington, D.C.: Government Printing Office.
- Knowles, John P. 1864. *Annual Report of the Commissioner of Shell Fisheries*. Providence.
- Lockwood. 1883. The American oyster and the oyster industry in New Jersey. *Fifth Annual Report of the Bureau of Statistics of Labor and Industries of the State of New Jersey*. Freehold.
- McDonald, Marshal. 1880. *Report upon the oysters and fisheries of tidewater Virginia*. Richmond: R. F. Walker.
- McKinney, Philip. 1892. *Special message of the Governor of Virginia to the General Assembly relative to oysters*. Richmond.
- Mobius, Karl. 1869. How can the cultivation of oysters, especially on the German coasts, be made permanently profitable? Translated *Report of the Commissioner of the United States Fish Commission for 1877*. Washington, D.C.: Government Printing Office.
- Mobius, Karl. 1878. The oyster and oyster culture. Translated in USFC. 1882. *Report of the United States Commission of Fish and Fisheries for 1880*. Washington, D.C.: Government Printing Office.
- Moore, H. F. 1899. Report on the oyster beds of Louisiana. In *Report of the Commissioner of Fish and Fisheries for the year 1898*. Washington, D.C.: Government Printing Office.
- Moore, H. F. 1911. Condition and extent of the oyster beds of James River, Virginia, 1909. In *Report of the Commissioner of Fish and Fisheries for the year 1909*. Washington, D.C.: Government Printing Office.
- Nelson, Julius. 1889. *Oyster interests of New Jersey, New Jersey Agricultural College Experiment Station. Special Bulletin E*. New Brunswick: Agricultural Experiment Station.
- Rice, J. H. 1883. Experiments in oyster propagation. *Forest and Stream* August 9, 21 (2): 28-9.
- Rowe, Henry C. 1893. *Deep water oyster culture*. In *Bulletin of the United States Fish Commission, No. 13*. Washington, D.C.: Government Printing Office.
- Rowe, Henry C. 1910. *The wholesomeness of oysters as food*. In *Bulletin of the United States Fish Commission, No. 28*. Washington, D.C.: Government Printing Office.
- Ryder, John. 1882a. Notes on the breeding, food, and cause of green color in oysters. *Forest and Stream* June 1, 18 (18): 349-51.

- Ryder, John. 1882b. Success in oyster culture. *Forest and Stream* September 14, 19 (7): 121.
- Ryder, John. 1882c. A summary of recent progress in our knowledge culture, growth and anatomy of the oyster. *Forest and Stream* November 30, 19 (18): 351-2.
- Ryder, John. 1883. The oyster problem solved. *Forest and Stream* August 30, 21 (5): 90.
- Ryder, John. 1885a. A new system of oyster culture. *Science* Vol. 6 (147): 465-467.
- Ryder, John. 1885b. The oyster problem actually solved. *Forest and Stream* October 22, 25 (18): 249-50.
- Stainsby, William. 1902. The oyster industry: A historical sketch. In *Twenty-fifth annual report of the Bureau of Statistics of New Jersey*. Trenton: Unionist-Gazette Association, State Printers.
- Stevenson, Charles H. 1894. Oyster industry of Maryland. In *Bulletin of the U.S. Commission of Fish and Fisheries for 1892*. Washington, D.C.: Government Printing Office.
- Stubbs, James N. 1891. *A defense of the tidewater oyster industry*. Richmond: Everett and Waddey Co.
- Swift, Franklin. 1897. Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George's Sound, Florida. In *Report of the Commissioner of Fish and Fisheries for the year ending 1896*. Washington, D.C.: Government Printing Office.
- Townsend, Charles H. 1893. Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. In *Report of the Commissioner of Fish and Fisheries for the year 1889-1891*. Washington, D.C.: Government Printing Office.
- Townsend, Charles H. 1896. Transplanting of eastern oysters to Willapa Bay, Washington, with notes on the native oyster industry. In *Report of the Commissioner of Fish and Fisheries for the year 1895*. Washington, D.C.: Government Printing Office.
- Winslow, Francis. 1885. The North Carolina oyster industry. *Forest and Stream* May 7, 24 (15): 292-3 and May 14, 24 (16): 332.
- Winslow, Francis. 1887. Report of the sounds and estuaries of North Carolina, with reference to oyster culture. In *United States Coast and Geodetic Survey, Bulletin No. 10*. Washington, D.C.: Government Printing Office.
- Whipple, George C., A. W. Freeman, Stephen De M. Gage, William Royal Stokes, H. D. Pease. 1911. Second progress report of the Committee on Standard Methods of Shellfish Examination. *American Journal of Public Health*.

Secondary sources

- Abbott, Andrew Delano. 1988. *The system of professions: An essay on the division of expert knowledge*. Chicago: University of Chicago Press.
- Adas, Michael. 1989. *Machines as the measure of men: Science, technology, and ideologies of Western dominance*. Ithaca: Cornell University Press.
- Adas, Michael. 2000. Seeing like a state. *Journal of Social History* 33 (4): 959-963.
- Agarwal, Arun. 2005. *Environmentality: Technologies of governance and the making of subjects*. Durham: Duke University Press.

- Allard Jr., Dean Conrad. 1978. *Spencer Baird and the U.S. Fish Commission*. New York: Arno Press.
- Appleby, Joyce. 1982. Commercial farming and the 'agrarian myth' in the early republic. *Journal of American History* 68 (4): 833-849.
- Appleby, Joyce. 1984. *Capitalism and a new social order: The republican vision of the 1790s*. New York: New York University Press.
- Arnold, David. 2000. *Science, technology, and medicine in India, 1760-1947*. Cambridge: Cambridge University Press.
- Balogh, Brian. 1991. Reorganizing the organizational synthesis: Federal-professional relations in modern America. *Studies in American Political Development* 5: 119-172.
- Barzun, Jacques and Henry Graff. 2004. *The modern researcher*. Belmont: Wadsworth.
- Bigelow, Erastus B. and William W. Welsh. 1925. *Fishes of the Gulf of Maine*. Washington: Government Printing Office.
- Bowker, Geoffrey C. and Susan Leigh Starr. 1999. *Sorting things out: Classification and its consequences*. Cambridge: MIT Press.
- Braun, Bruce. 2000. Producing vertical territory: Geology and governmentality in late Victorian Canada. *Ecumene* 7 (1): 7-46.
- Brubaker, Rogers. 1984. *The limits of rationality: An essay on the social and moral thought of Max Weber*. London: George Allen and Unwin.
- Burnett, D. Graham. 2000. *Masters of all they surveyed: Geography, exploration, and a British El Dorado*. Chicago: University of Chicago Press.
- Busch, Lawrence, and William B. Lacy. 1983. *Science, agriculture, and the politics of research*. Boulder: Westview Press.
- Carriker, Melbourne Romaine. 2004. *Taming of the oyster: A history of evolving shellfisheries and the National Shellfish Association*. Hanover, PA: Sheridan Press.
- Carmichael, Mary Cornish. 1984. *Oh boy! Roy joy!* New York: Vintage Press.
- Carter, Paul. 1987. *The road to Botany Bay: An essay on spatial history*. Boston: Faber and Faber.
- Chambers, John Whiteclay. 1992. *The tyranny of change: America in the Progressive Era, 1890-1920*. New York: St. Martin's Press.
- Creswell, John. 2003. *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks: Sage Publications.
- Cronon, William. 1992. A place for stories: Nature, history, and narrative." *Journal of American History* 78 (4): 1347-1376.
- Danbom, David B. 1986. The agricultural experiment station and professionalism: Scientists' goals for agriculture, 1887-1910. *Agricultural History* 60 (2): 246-255.
- Demeritt, David. 2001. Scientific forest conservation and the statistical picturing of nature's limits in the Progressive Era. *Environment and Planning D* 19 (4): 431-459.
- Drayton, Richard. 2000. *Nature's government: Science, imperial Britain, and the 'improvement' of the world*. New Haven: Yale University Press.
- Edney, Matthew. 1997. *Mapping an empire: The geographical construction of British India, 1765-1843*. Chicago: University of Chicago Press.

- Evenden, Matthew. 2004. Locating science, locating salmon: Institutions, linkages, and spatial practices in early British Columbia fisheries science. *Environment and Planning D* 22 (3): 355-372.
- Galpin, Virginia M. 1989. *New Haven's oyster industry, 1638-1987*. New Haven: New Haven Colony Historical Society.
- Galtsoff, Paul. 1972. *Bibliography of oysters and other marine organisms*. East Kingston: G.E Hall.
- Golinski, Jan. 1998. *Making natural knowledge: Constructivism and the history of science*. Cambridge: Cambridge University Press.
- Goodwyn, Lawrence. 1978. *The populist moment: A short history of the agrarian revolt in America*. New York: Oxford University Press.
- Hacking, Ian. 1999. *The social construction of what?* Cambridge: Harvard University Press.
- Hamilton, David. 1990. Building the associative state: The Department of Agriculture and American state-building. *Agricultural History* 64 (2): 207-218.
- Hardin, Garrett. 1968. The Tragedy of the Commons. *Science* 162: 1243-1248.
- Harley, J. B. 2001. *The new nature of maps: Essays in the history of cartography*. Baltimore: Johns Hopkins University Press.
- Hays, Samuel P. 1959. *Conservation and the gospel of efficiency: The progressive conservation movement, 1890-1920*. Pittsburgh: University of Pittsburgh Press.
- Hull, David. 1988. *Science as a process: An evolutionary account of the social and conceptual development of science*. Chicago: University of Chicago Press.
- Jacoby, Karl. 2001. *Crimes against nature: Squatters, poachers, thieves, and the hidden history of American conservation*. Berkeley: University of California Press.
- Jasanoff, Sheila, ed. 2004. *States of knowledge: The co-production of science and the social order*. New York: Routledge.
- Judd, Richard W. 1997. *Common lands, common people: The origins of conservation in Northern New England*. Cambridge: Harvard University Press.
- Kain, Roger J. P. and Elizabeth Baigent. 1992. *The cadastral map in the service of the state*. Chicago: University of Chicago Press.
- Keiner, Christine. 2001. *Scientists, oystermen, and Maryland oyster conservation politics, 1880-1969: A study of two cultures*. Ph.D. diss., Johns Hopkins University.
- Kennedy, V. S., and L. L. Breisch. 1983. Sixteen decades of political management of the oyster fishery in Maryland's Chesapeake Bay. *Journal of Environmental Management* 16 (2): 153-171.
- King, F. H. 1911. *Farmers of forty centuries, or permanent agriculture in China, Korea and Japan*. Emmaus: Rodale Press.
- Kinsey, Darin. 2006. Seeding the water as the earth: The epicenter of and peripheries of a western aquaculture revolution. *Environmental History* 11 (3): 527-566.
- Kirkendall, Richard S. 1986. The agricultural colleges: Between tradition and modernization. *Agricultural History* 60 (2):3-21.
- Kirsch, S. 2002. John Wesley Powell and the mapping of the Colorado Plateau, 1869 – 1879: Survey science, geographical solutions, and the economy of environmental values. *Annals of the Association of American Geographers* 92 (3): 548-572.

- Knorr Cetina, Karin D. 1981. *The manufacturing of knowledge: An essay on the constructivist and contextual nature of science*. Oxford: Pergamon Press.
- Kochkiss, John M. 1974. *Oystering from New York to Boston*. Middletown, CN: Wesleyan University Press.
- Kohlstedt, Sally Gregory, ed. 1991. *The origins of natural science in America: The essays of George Brown Goode*. Washington, DC: Smithsonian Institution Press.
- Kurlansky, Mark. 2006. *The big oyster: History on the half shell*. New York: Random House.
- Lane, K. Maria D. 2005. Geographers of Mars: Cartographic inscription and exploration narrative in late Victorian representations of the red planet. *Isis* 96: 477-506.
- Langston, Nancy. 1995. *Forest dreams, forest nightmares: The paradox of old growth in the inland west*. Seattle: University of Washington Press.
- Latour, Bruno. 1999. *Pandora's hope: Essays on the reality of science studies*. Cambridge: Cambridge University Press.
- Lewis, D. 1986. *Philosophical papers, vol. 2*. New York: Oxford University Press.
- Livingstone, David N. 2003. *Putting science in its place: Geographies of scientific knowledge*. Chicago: University of Chicago Press.
- MacKenzie, Clyde L. 1991. Bibliographic memoir of Ernst Ingersoll: Naturalist, shellfish scientist, and author. *Marine Fisheries Review* 53 (5): 23-29.
- MacKenzie, Clyde L. 1996. History of oystering in the United States and Canada, featuring eight great oyster estuaries. *Marine Fisheries Review* 58 (4):1-78.
- Maienschein, Jane. 1991. *Transforming traditions in American biology, 1880-1915*. Baltimore: Johns Hopkins Press.
- Manners, Ian R. 1997. Constructing the Image of a City: The Representation of Constantinople in Christopher Buondelmonti's *Liber Insularum Archipelagi*. *Annals of the Association of American Geographers* 87 (1): 72-102.
- Marcus, Alan I. 1985. *Agricultural science and the quest for legitimacy: Farmers, agricultural colleges, and experiment stations, 1879-1890*. Ames: Iowa State University Press.
- Markowitz, Gerald and Rosner, David. 2002. *Deceit and denial: The deadly politics of industrial pollution*. Berkeley: University of California Press.
- McCay, Bonnie. 1989. Sea tenure and the culture of the commoners. In *A sea of small boats*. J. Cordell, ed. Cambridge: Cultural Survival.
- McCay, Bonnie J. 1998. *Oyster wars and the public trust: Property, law, and ecology in New Jersey history*. Tucson: University of Arizona Press.
- McCay, Bonnie J. and James M. Acheson, eds. 1987. *The question of the commons: The culture and ecology of communal resources*. Tucson: University of Arizona Press.
- McEvoy, Arthur. 1986. *The fisherman's problem: Ecology and law in the California fisheries, 1950-1980*. Cambridge: Cambridge University Press.
- Melosi, Martin V. 1981. *Garbage in the cities: Refuse, reform and the environment, 1880-1980*. College Station: Texas A & M Press.
- Melosi, Martin. 2000. *The sanitary city: Urban infrastructure in American from colonial times to the present*. Baltimore: Johns Hopkins Press.
- Merkle, Judith A. 1980. *Management and ideology: The legacy of the international scientific management movement*.

- Miller, Mary E. 1962. The Delaware oyster industry, past and present. Ph.D. diss., Boston University.
- Mitchell, Timothy. 2002. *Rule of experts: Egypt, techno-science, and modernity*. Berkeley: University of California Press.
- Nash, Roderick. 1967. *Wilderness and the American mind*. New Haven: Yale University Press.
- National Research Council. 2004. *Nonnative oysters in the Chesapeake Bay*. Washington, DC: National Academies Press.
- Naylor, Simon. 2005. Historical geographies of science - places, contexts, cartographies. *British Journal for the History of Science* 38 (1): 1-12.
- Neild, Robert. 1995. *The English, the French, and the oyster*. London: Quiller Press.
- Neumann, Roderick P. 1998. *Imposing wilderness: Struggles over livelihood and nature preservation in Africa*. Berkeley: University of California Press.
- Nussbaum, Martha. 1986. *The fragility of goodness: Luck and ethics in Greek tragedy and philosophy*. Cambridge: Cambridge University Press.
- O'Neill, Karen. 2006. *Rivers by design: State power and the origins of U.S. flood control*. Durham: Duke University Press.
- Pauly, Philip J. 2000. *Biologists and the promise of American life: From Meriwether Lewis to Alfred Kinsey*. Princeton: Princeton University Press.
- Plummer, Norman H. 1993. *Maryland's oyster navy: The first fifty years*. Chesterton: Washington University Press.
- Porter, Theodore. 1995. *Trust in numbers: The pursuit of objectivity in science and public life*. Princeton: Princeton University Press.
- Powell, Richard C. 2007. Geographies of science: Histories, localities, practices, futures. *Progress in Human Geography* 31 (3): 309-329.
- Princen, Thomas. 2005. *The logic of sufficiency*. Cambridge: MIT Press.
- Reeves, R., T. D. Smith, E. Josephson, P. Claphan, and G. Woolmer. 2004. Historical observations of humpback and blue whales in the North Atlantic Ocean: Clues to migratory routes and possibly additional feeding grounds. *Marine Mammal Science* 20 (4): 774-786.
- Rice, Michael. 2006. *A brief history of oyster aquaculture in Rhode Island*. Wakefield: Coastal Resource Management Council.
- Rosenberg, Charles. 1971. Science, technology, and economic growth: The case of the agricultural experiment station scientists, 1875-1914. *Agricultural History* 45: 1-20.
- Rosenberg, Charles. 1977. Rationalization and reality in the shaping of American agricultural research, 1875-1914. *Social Studies of Science* 7: 401-422.
- Ryan, Simon. 1996. *The cartographic eye: How explorers saw Australia*. Cambridge: Cambridge University Press.
- Sanders, Elizabeth. 1999. *Roots of reform: Farmers, workers, and the American state, 1877-1917*. Chicago: University of Chicago Press.
- Schneider, Daniel W. 2000. Local knowledge, environmental politics, and the founding of ecology in the United States: Stephen Forbes and 'The Lake as a Microcosm' (1887). *Isis* 91 (4): 681-705.
- Scott, James C. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven: Yale University Press.

- Shapin, Steven and Simon Schafer. 1985. *Leviathan and the air pump: Hobbs, Boyle, and the experimental life*. Princeton: Princeton University Press.
- Sivaramakrishnan, K. 1999. *Modern forests: Statemaking and environmental change in colonial Eastern India*. Stanford: Stanford University Press.
- Smith, Tim D. 1994. *Scaling fisheries: The science of measuring the effects of fishing, 1855-1955*. Cambridge: Cambridge University Press.
- Taylor, Joseph E. 1998. Making salmon: The political economy of fisheries science and the road not taken. *Journal of the History of Science* 31: 33-59.
- Taylor, Lawrence. 1983. *Dutchmen on the bay: The ethnohistory of a contractual community*. Philadelphia: University of Pennsylvania Press.
- Thompson, E. P. 1963. *The making of the English working class*. London: V. Gollancz.
- Thoreau, Henry David. 1985 [1865]. *Cape Cod*. New York: Penguin Putnam.
- Thorton, Joe. 2000. *Pandora's poison: Chlorine, health, and a new environmental strategy*. Cambridge: MIT Press.
- Towle, Jerry C. 2000. Authored ecosystems: Livingston Stone and the transformation of California fisheries. *Environmental History* 5 (1):54-74.
- Townsend, Charles H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. *Zoologica* 19 (1): 1-50.
- Traweek, Sharon. 1988. *Beamtimes and lifetimes: The world of high energy particle physics*. Cambridge: Harvard University Press.
- Wallace, Anthony F.C. 1999. *Jefferson and the Indians: The tragic fate of the first Americans*. Cambridge: Belknap Press of Harvard University.
- Weber, Max. 1977. *Economy and society: An outline of interpretive sociology*. Berkeley: University of California Press.
- Weber, Michael L. 2002. *From abundance to scarcity: The history of the National Marine Fisheries Service*. Washington, D.C.: Island Press.
- Wennersten, John R. 1981. *The oyster wars of Chesapeake Bay*. Centerville: Tidewater Publishers.
- White, Richard. 1996. *The organic machine: The Remaking of the Columbia River*. New York City: Hill and Wang.
- Wiebe, Robert H. 1967. *The search for order, 1877-1920*. Westport, Connecticut: Greenwood Press.
- Williams, Raymond. 1973. *The country and the city*. New York City: Oxford University Press.
- Winichakul, Thongchai. 1994. *Siam mapped: A history of the geo-body of a nation*. Honolulu: University of Hawaii Press.
- Wittfogel, Karl. 1957. *Oriental despotism: A comparative study in total power*. New Haven: Yale University Press.
- Worster, Donald. 1985. *Rivers of empire: Water, aridity, and the growth of the American West*. New York: Pantheon Books.

Curriculum Vita

Samuel Paris Hanes

Education

October 2008, Ph.D., Geography, Rutgers University, New Brunswick

Dissertation: "The High Modernist Moment: Oysters, Knowledge Production, and Conservation in the Progressive Era, 1878-1917"

October 2002, Master of Arts, Geography, Rutgers University, New Brunswick

Masters Thesis: "A Monument in the Making: an Environmental History of New York's Freshkills Landfill"

May 2000, Bachelor of Arts, Geography, University of Texas, Austin

Honors Thesis: "Opportunities at Urban Conservation Areas: a Comparative Analysis"

Employment

Fall 2006- Fall 2008, Fall 2006- Spring 2008, Teaching Assistant, English Department, and Part-time Lecturer, Human Ecology Department, Rutgers University

Fall 2004- Spring 2006, Part-time Lecturer, Geography Department, Rutgers University

Fall 2002- Spring 2004, Teaching Assistant, Geography Department, Rutgers University

Fall 2000- Spring 2002, Graduate Fellow, Geography Department, Rutgers University